BROOKLYN BOTANIC GARDEN

PLANTS & GARDENS

BROOKLYN BOTANIC GARDEN RECORD

PLANTS & GARDENS

HANDBOOK ON FLOWERING SHRUBS

SPRING
1964

Selections
for Different
Regions
Situations
Uses
Times of Bloom
Effects of
Fruits and
Foliage

Planting
Culture
Pruning

Hunting
for New Plants

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Paul F. Frese

For spring bloom—an azalea garden in a woodland setting

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Spring 1964

There are something over a thousand different kinds of flowering shrubs that are candidates for planting in mild or temperate climates. Not all are of equal horticultural merit. Guest Editor Harkness and his knowledgeable authors have chosen about 200 for treatment in this Handbook.

There will be differences of opinion on the regional selections (pages 34 to 57), but the choices are important for two very good reasons: 1) Experienced plantsmen have suggested them, and 2) if particular kinds will thrive in a given region, so will certain others that have similar temperature, moisture and soil requirements (local nurserymen can help on this). Many gardeners will want to use this Handbook in conjunction with the one on the "100 Finest Trees and Shrubs."

A warning is in order to home owners who are choosing flowering shrubs for the first time: the illustrations here and in nursery catalogs generally feature the blossoms. But stop, look and listen! Blossoms are but one of the many qualities one seeks in a good shrub; they may last only for one or two weeks, yet there are fifty-two weeks in the year. What about foliage? Over-all shape? Growth characteristics? If deciduous, what about the winter interest of the many stems, their color, and the quality of their bark? If evergreen, what of the texture of their foliage and relative beauty in the winter landscape? Are the plants to be used for their low screening effect or for some other special need?

The questions raised are not intended to make the job of selection difficult but—rather—to point out that once in the ground, a shrub (or tree, for that matter) is lived with the year around. Its changes of apparel are few and depend upon the season. It might be compared to living with a woman whose wardrobe is small, yet expecting her to be attractive and nattily clad whatever the time of day or year. Obviously, to some extent, one must sacrifice one season for another, and tastes are certain to differ.

My favorite shrubs? For its architecturally magnificent pink-to-white blossoms, evergreen foliage, asymmetrical branching habit and fine-textured bark (as it grows older), I put mountain-laurel *(Kalmia latifolia)* near the top of the list for the eastern United States and similar climates. For its delicate and unusual yellow blossoms that come in winter, when its leaves are off, Chinese witch-hazel is a shrub of distinction. Flowering quince and forsythia, brave bloomers that they are in the colder days of early spring, deserve a place in every garden where the climate and sunlight suit their not-too-fastidious taste. But who can stop with a few favorites when there are so many fine shrubs from which to choose? For nostalgia, choose lilacs for their scented blossoms in mid-spring, but plant them where their commonplace foliage, ungraceful growth habit and tendency to send up spreading "sucker" shoots will not be a garden liability during the long months when they are not in bloom.

This may be the year to up-grade your shrub collection.

Sincerely yours,

George S. Avery, Jr.

Director

SHRUBS FOR SPECIAL SITUATIONS

Wet Areas

Buttonbush—*Cephalanthus occidentalis*
Tatarian Dogwood—*Cornus alba*
Silky Dogwood—*Cornus amomum*
Leatherwood—*Dirca palustris*
Winterberry—*Ilex verticillata*
Spicebush—*Lindera benzoin*
Mountain-holly—*Nemopanthus mucronatus*
Swamp Azalea—*Rhododendron viscosum*
Goat Willow—*Salix caprea*
American Elder—*Sambucus canadensis*

Dry Areas

Leadplant—*Amorpha canescens*
New-Jersey-tea—*Ceanothus americanus*
Gray Dogwood—*Cornus racemosa*
Sweet-gale—*Myrica gale*
Ninebark—*Physocarpus opulifolius*
Glossy Buckthorn—*Rhamnus frangula*
Rose-acacia—*Robinia hispida*
Buffalo-berry—*Shepherdia canadensis*
Tamarisk—*Tamarix pentandra*

Acid Soils

Heather—*Calluna vulgaris*
Cinnamon Clethra—*Clethra acuminata*
Redvein Enkianthus—*Enkianthus campanulatus*
Large Fothergilla—*Fothergilla major*
Finetooth Holly—*Ilex serrata*
Mountain-laurel—*Kalmia latifolia*
Drooping Leucothoë—*Leucothoë editorum* (*L. catesbaei*)
Sweet-bay—*Magnolia virginiana*
Bayberry—*Myrica pensylvanica*
Zenobia—*Zenobia pulverulenta*

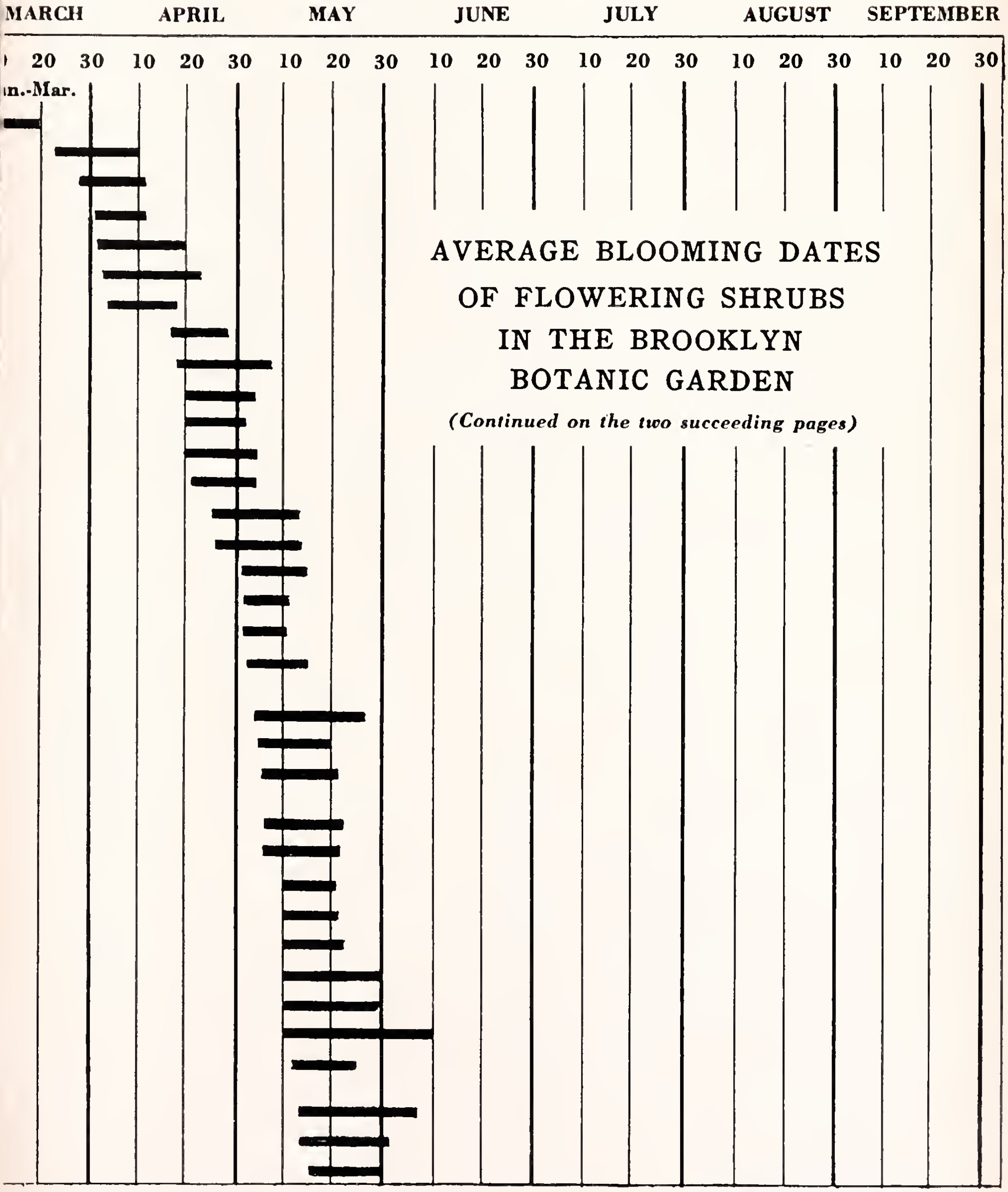
Limestone Areas

Siberian Pea-tree—*Caragana arborescens*
Spreading Cotoneaster—*Cotoneaster divaricata*
Snowy Deutzia—*Deutzia scabra*
Cherry Elaeagnus; Gumi-cherry—*Elaeagnus multiflora*
Kerria—*Kerria japonica*
Sweet Mock-orange—*Philadelphus coronarius*
Mongolian Prinsepia—*Prinsepia uniflora*
Cutleaf Stephanandra—*Stephanandra incisa*
Chinese Lilac—*Syringa chinensis*
Yellowhorn—*Xanthoceras sorbifolium*

FLOWERING SHRUBS

Japanese Witch-hazel *(Hamamelis japonica*
Spring Witch-hazel *(Hamamelis vernalis)*
Early Forsythia *(F. ovata)*
Drooping Forsythia *(F. suspensa)*
Forsythia *(F. intermedia)*
Japanese Pieris *(P. japonica)*
Mountain Pieris *(P. floribunda)*
Spicebush *(Lindera benzoin)*
Oregon-grape *(Mahonia aquifolium)*
Red Chokeberry *(Aronia arbutifolia)*
Redbud *(Cercis canadensis)*
Royal Azalea *(Rhododendron schlippenbachi)*
Large Fothergilla *(F. major)*
Black Chokeberry *(Aronia melanocarpa)*
Beach Plum *(Prunus maritima)*
Enkianthus perulatus
Carolina Rhododendron *(R. carolinianum*
Spreading Cotoneaster *(C. divaricata)*
Rockspray *(Cotoneaster horizontalis)*
Common Lilac *(Syringa vulgaris)*
Kurume Azalea *(Rhododendron obtusum* hybrids*)*
Persian Lilac *(Syringa persica)*
Pontic Azalea *(Rhododendron luteum)*
Double-file Viburnum *(Viburnum plicatum tomentosum)*
Bladdernut *(Staphylea trifolia)*
Siebold Viburnum *(Viburnum sieboldi)*
Snow-wreath *(Neviusia alabamensis)*
Redvein Enkianthus *(E. campanulatus)*
Chinese Lilac *(Syringa chinensis)*
Rugosa Rose *(Rosa rugosa)*
Japanese Snowball *(Viburnum plicatum)*
Van-Houtte Spirea *(Spiraea vanhouttei)*
Sweet-shrub, Carolina Allspice *(Calycanthus floridus)*
Shrubby Cinquefoil *(Potentilla fruticosa)*
Fringe-tree *(Chionanthus virginicus)*

AND SUCCESSION OF BLOOM



AVERAGE BLOOMING DATES OF FLOWERING SHRUBS IN THE BROOKLYN BOTANIC GARDEN

(Continued on the two succeeding pages)

(Continued on pages 6 and 7)

Seashore Planting

Groundsel-bush; Sea-myrtle—*Baccharis halimifolia*
Sweet Pepperbush; Summer-sweet—*Clethra alnifolia*
Sweet-fern—*Comptonia peregrina*
Red-osier Dogwood—*Cornus stolonifera*
Salt-tree—*Halimodendron halodendron*
Sea-buckthorn—*Hippophaë rhamnoides*
Morrow Honeysuckle—*Lonicera morrowi*
Beach Plum—*Prunus maritima*
Rugosa Rose—*Rosa rugosa*
Withe-rod—*Viburnum cassinoides*

City Gardens

Five-leaf Aralia—*Acanthopanax sieboldianus*
Butterfly-bush—*Buddleia davidi*
Japanese Dwarf Quince—*Chaenomeles japonica*
Cornelian-cherry—*Cornus mas*
Slender Deutzia—*Deutzia gracilis*
Burning-bush—*Euonymus alatus*
Rose-of-Sharon—*Hibiscus syriacus*
Oregon-grape—*Mahonia aquifolium*
Laland Firethorn—*Pyracantha coccinea lalandi*
Korean Spice Viburnum—*Viburnum carlesi*

Dense Shade

Glossy Abelia—*Abelia grandiflora*
Black Chokeberry—*Aronia melanocarpa*
Wintersweet—*Chimonanthus praecox*
Miyama Corylopsis—*Corylopsis glabrescens*
Willowleaf Cotoneaster—*Cotoneaster salicifolia floccosa*
Wild Hydrangea—*Hydrangea arborescens*
Inkberry—*Ilex glabra*
Himalayan Sweet-box—*Sarcococca hookeriana humilis*
Japanese Kibushi—*Stachyurus praecox*
Yellowroot—*Xanthorhiza simplicissima*

Holding Foliage Late in Fall

Willowleaf Cotoneaster—*Cotoneaster salicifolia floccosa*
Headed Broom—*Cytisus supinus*
Rosy Dipelta—*Dipelta floribunda*
Mid-winter Euonymus—*Euonymus bungeana semipersistens*
Italian Privet—*Ligustrum vulgare persistens*
Fragrant Honeysuckle—*Lonicera fragrantissima*
Manchurian Prinsepia—*Prinsepia sinensis*
Chinese Buckthorn—*Rhamnus utilis*
Judd Viburnum—*Viburnum juddi*
Suringar Viburnum—*Viburnum rhytidophylloides*

(*Continued from pages 4 and 5*)

FLOWERING SHRUBS

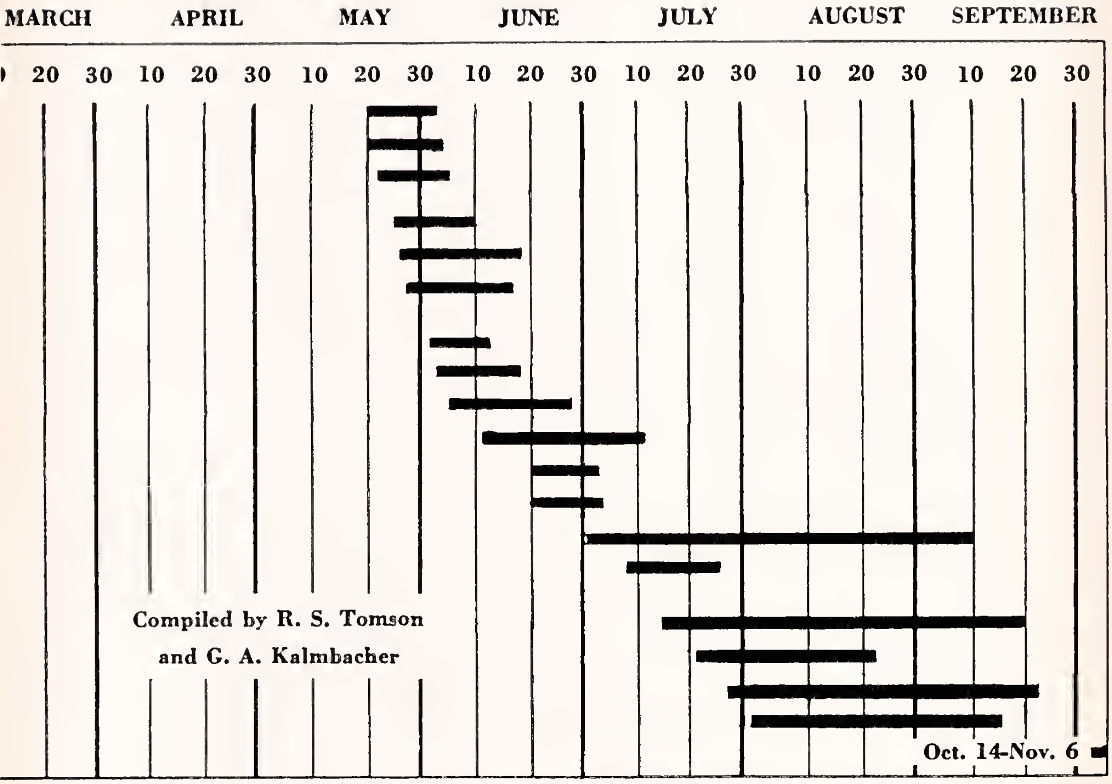
Japanese Snowbell *(Styrax japonica)*
Pinxterbloom *(Rhododendron nudiflorum*
Wayfaring-tree *(Viburnum lantana)*
Arrow-wood *(Viburnum dentatum)*
Sheep-laurel *(Kalmia angustifolia)*
Mountain-laurel *(Kalmia latifolia)*
Willow-leaf Cotoneaster *(C. salicifolia floccosa)*
Withe-rod *(Viburnum cassinoides)*
Elderberry *(Sambucus canadensis)*
Oakleaf Hydrangea *(H. quercifolia)*
Rosebay Rhododendron *(R. maximum)*
Prairie Rose *(Rosa setigera)*
Glossy Abelia *(A. grandiflora)*
Buttonbush *(Cephalanthus occidentalis)*
Harlequin Glory-bower *(Clerodendron trichotomum)*
Sweet Pepperbush *(Clethra alnifolia)*
Heather *(Calluna vulgaris)*
Rose-of-Sharon *(Hibiscus syriacus)*
Common Witch-hazel *(Hamamelis virginic*

High-growing Shrubs

Double Lilac—*Syringa hyacinthiflora plena*
Mock-orange—*Philadelphus virginalis*
Pea-shrub—*Caragana arborescens*
Euonymus—*E. bungeana*
Japanese Witch-hazel—*Hamamelis japonica*
Sea-buckthorn—*Hippophaë rhamnoides*
Photinia—*Photinia serrulata*
Hardy Orange—*Poncirus trifoliata*
Yellowhorn—*Xanthoceras sorbifolium*

Spreading Shrubs Needing Ample Space

Smoke-tree—*Cotinus coggygria*
Buckeye—*Aesculus parviflora*
Witch-hazel—*Hamamelis virginiana*
Morrow Honeysuckle—*Lonicera morrowi*
Honeysuckle—*Lonicera fragrantissima*
Doublefile Viburnum—*V. plicatum tomentosum*
Siebold Viburnum—*V. sieboldi*
Common Privet—*Ligustrum vulgare*
Spicebush—*Lindera benzoin*
Elderberry—*Sambucus canadensis acutiloba*



Useful Shrubs of Moderate Heights

	Ultimate Height
Mountain Pieris—*Pieris floribunda*	5′
Persian Lilac—*Syringa persica*	
Fragrant Sumac—*Rhus aromatica*	4′
Rhododendron laetevirens	4′
Honeysuckle—*Lonicera pileata*	4′
Hybrid Coralberry—*Symphoricarpos chenaulti*	3½′
Indigofera kirilowi	3′
St.-John's-wort—*Hypericum kalmianum*	3′
Broom—*Cytisus purgans*	3′
Inkberry—*Ilex glabra*	2½′

Shrubs for Floral Fragrance

Chimonanthus praecox
Sweet Pepperbush—*Clethra alnifolia*
Chinese Witch-hazel—*Hamamelis mollis*
White Jasmine—*Jasminum officinale*
Sweet-olive—*Osmanthus ilicifolius*
Mock-orange—*Philadelphus coronarius*
Flowering Currant—*Ribes odoratum*
Lilac—*Syringa vulgaris*
Korean Spice Viburnum—*V. carlesi*
Fragrant Viburnum—*V. fragrans*

Roche

Vernal witch-hazel (*Hamamelis vernalis*) has yellow flowers in very early spring, orange and yellow leaves in autumn.

Grossman

Kurume azalea, one of a hybrid group of rhododendrons. Other Kurumes have flowers that range from white, as in 'Snow' (above), to deep crimson. They are favorites for spring flowering in nearly all climates. Leaves are small, shining, and persist throughout the year in all except the coldest regions. Originated near the City of Kurume, in Japan.

Winter Effect

Chalkleaf Barberry—*Berberis dictyophylla* (white stems)
Korean Barberry—*Berberis koreana* (winged spines)
Chinese Fringe-tree—*Chionanthus retusus* (exfoliating tan bark)
Japanese Clethra—*Clethra barbinervis* (patchy exfoliating bark)
Siberian Dogwood—*Cornus alba sibirica* (bright red stems)
Yellowtwig Dogwood—*Cornus stolonifera flaviramea* (yellow stems)
Contorted European Hazel—*Corylus avellana* 'Contorta' (twisted stems)
Winged Euonymus—*Euonymus alatus* 'Monstrosus' (extra wide wings)
Japanese Witch-hazel—*Hamamelis japonica* (late winter bloom)
Ninebark—*Physocarpus opulifolius* (stringy bark exfoliation)
Hardy Orange—*Poncirus trifoliatus* (green stems)

Best Autumn Foliage Color

Korean Barberry—*Berberis koreana* (red)
Redvein Enkianthus—*Enkianthus campanulatus* (orange to scarlet)
Burning-bush—*Euonymus alata* (flaming red)
Greenstem Forsythia—*Forsythia viridissima* (purplish)
Ozark Witch-hazel—*Hamamelis vernalis* (yellow and orange)
Oregon-grape—*Mahonia aquifolium* (reddish purple)
Shining Sumac—*Rhus copallina* (shining red)
Virginia Rose—*Rosa virginiana* (red and yellow)
Bridal-wreath—*Spiraea prunifolia* 'Plena' (glossy red)
Maple-leaf Viburnum—*Viburnum acerifolium* (lavender to red)

Colorful Fruits

American Beautyberry—*Callicarpa americana* (lavender)
Japanese Cornelian-cherry—*Cornus officinalis* (scarlet)
Cranberry Cotoneaster—*Cotoneaster apiculata* (red)
Autumn Elaeagnus—*Elaeagnus umbellata* (silvery red)
Sea-buckthorn—*Hippophaë rhamnoides* (orange)
Mistletoe Honeysuckle—*Lonicera quinquelocularis* (translucent)
Tatarian Honeysuckle—*Lonicera tatarica* (red or yellow)
Sapphire-berry—*Symplocos paniculata* (blue)
Withe-rod—*Viburnum cassinoides* (green, red to black)
Linden Viburnum—*Viburnum dilatatum* (deep crimson)

CHOICE LOW-GROWING SHRUBS

Finding them is a challenge for the gardener

Harold Epstein

THE introduction of new plants from their native wild sources to the home garden usually consumes many years of evaluation and testing. The average nurseryman in the struggle for economic survival seldom has the financial strength to experiment with any large quantity of unknown plants. Even if he does uncover an appealing plant, there is always the problem of publicity, advertising and distribution, in order to reap some proportionate financial reward. While the United States Plant Patent law has substantially assisted the "creator" or "discoverer" of new plants, it has been primarily used as a protective device for the plant breeder working with the more familiar plants, such as roses. The popularity of roses makes the introduction of new kinds "big business," involving substantial capital for full exploitation of the "products," and generally bringing in a comparable return.

On the other hand, that rare individual, the dedicated nurseryman who has the curiosity and inclination to experiment with and evaluate new plants is seldom adequately rewarded. This situation is apparently recognized in the trade. Witness a page from my own experience:

Over a period of years of selecting and evaluating plants, particularly dwarf and unusual shrubs, several subjects have been outstanding enough to appear to warrant introduction with appropriate publicity. A nearby nurseryman, who is a skillful grower and a connoisseur of plants, was offered several of these relatively unknown shrubs without cost for commercial propagation and introduction. Visitors and friends who had appreciated these rarities were seeking a source for them. But for varying reasons my offers to the nurseryman were declined.

One of these plants was *Abeliophyllum distichum,* a hardy Korean shrub which had been introduced into cultivation in 1924 and into my garden about 1940. Still having faith in the merits of the shrub, I was not surprised to notice its introduction by a leading nursery as "white forsythia" several years after my offer to the neighboring nurseryman. Then, I was amused to discover a quantity of this same plant in salable sizes that my nurseryman friend had acquired for resale. He had apparently forgotten his refusal of my original propagating stock. It merely required a more substantial introducer with funds for advertising to encourage distribution and sale, to the home gardener. This same type of incident has occurred with several other plants that have been offered for distribution.

These examples illustrate the difficulties involved in disseminating new and unknown plants. The horticultural enthusiast today has to be like a sleuth with a bloodhound when he seeks rare or distinctive plants. Keen nurserymen and great assortments of hardy plants have been in diminishing supply in the U.S.A. since World War II. Relatively few commercial growers today are dedicated to the collecting and offering of rare plants. Occasionally a very enthusiastic amateur will turn to commercialism and in many cases contribute substantially toward broadening the sale of lesser-known plants. But it is often a self-sacrificing effort.

In recommending a group of rare small shrubs, there is the usual problem of determining a source for them. The plants described here are in cultivation, but diligence will be required to locate nurseries propagating them. While many people devote days or weeks to seeking

Longwood Gardens

Daphne genkwa exhibits a mass of lilac-blue flowers in April and May. Plants should be set out where they are expected to remain; they transplant poorly. A native of China.

antiques for their homes, the same amount of effort spent exploring private plantings, commercial nurseries and botanic gardens should produce equal satisfaction in locating plants to enhance the home's exterior.

Happy hunting!

Shrubs to Explore For

Daphne genkwa is a beautiful deciduous shrub, slender and rather erect in habit, about 3 to 4 feet high. The flowers, lilac to lilac-blue, are produced along the leafless branches in April and May. Unfortunately, they are scentless.

This native of China was introduced by Robert Fortune in 1843. Although a comparatively easily established shrub, it has not been widely distributed. For many years it had been primarily propagated from top cuttings, but root cuttings are now known to be faster and more dependable. As with most other daphnes, the cuttings should be rooted in pots or other containers, for moving them from the open ground is a difficult and risky operation. A word of caution is offered also for well-established plants, for this daphne is virtually impossible to move successfully. So in selecting a site for it, choose one which will be permanent.

Peculiarly, this plant is a great challenge to British horticulturists. It is a weak grower there and I cannot recall ever seeing a strong or substantial plant in any of the gardens, nurseries or institutions visited. Like most daphnes, it may suddenly collapse and die without any apparent cause. But in the United States, it is an easy and dependably hardy plant—not ever having been injured by the severity of winter. In my own garden it is planted in front of a large gray granite outcrop, which serves as an excellent backdrop when the plant is in bloom. In the foreground of the daphne is a group of the finest of dwarf rhododendrons—*R. racemosum,* a dependably dwarf species discovered in China by George Forrest (#19404). The deep pink color makes a charming combination with *Daphne genkwa.*

Fothergilla gardeni of the southeastern United States is one of several native shrubs which regrettably are not sufficiently appreciated. In fact, the larger species of the genus, *F. major* and *F. monticola,* are also excellent garden plants, yet they are seldom listed by nurseries. Like many other American plants, they are more actively appreciated abroad, particularly in England, and are thus more readily available there.

F. gardeni is a deciduous shrub usually 2 to 3 feet high, with slender and rather spreading branches. Its most conspicuous period is during flowering in April and May when its erect, fragrant inflorescences, composed principally of clusters of white stamens, cover the plant like so many bottle-brushes. The foliage, which appears afterward, often turns crimson and gold in the autumn.

Cultivation is comparatively easy, the plant's preference being for a peaty and sandy loam. It is easily propagated from suckers and root cuttings. A plant of this species was placed in a rather restricted rock pocket at the base of a slope in my garden about twelve years ago. It has since overgrown its limited area and is now about 5 feet in diameter. It is a charming specimen plant for the woodland.

The fourth species of the genus is *F. parvifolia,* a shrub scarcely 2 feet tall, growing in the coastal plain from Florida to North Carolina. I have been unable to locate this plant in cultivation either in the United States or abroad and I solicit any leads toward obtaining it.

This genus commemorates Dr. John Fothergill, an eminent English physician, who in the mid-eighteenth century cultivated one of the earliest and most extensive collections of American plants.

Hydrangea involucrata is a dwarf, deciduous, Japanese species, usually 18 to 24 inches tall, depending on exposure and soil. The leaves, in scale with the plant, are about 5 inches long and 2½ inches wide.

The plant is very pretty when in bloom

Gottscho-Schleisner

Rhododendron racemosum, a natural dwarf from China, with flowers of deep pink.

(latter half of August into September), the blue fertile flowers making an effective contrast with the large sterile white ones around them.

There is also a variety, *hortensis,* which is a remarkable and attractive double form with each twig terminating in a loose panicle of doubled sterile flowers, creamy white, fading to pink. These inflorescences suggest the pendent double begonias so popular now. They last for many weeks and are most decorative.

These hydrangeas are easily cultivated, thriving in well-drained loamy soil, but they resent dryness at the roots. They bloom most freely in full sun but will also do well in partial shade. They are easily propagated by green or half-ripened cuttings in the summer.

Although introduced into cultivation about 1840 by Von Siebold, this species is extremely uncommon and unfortunately is rarely encountered in the nurseries. Yet it is a reliable little shrub. It makes a neater plant if it is pruned back severely in early spring.

Indigofera incarnata alba (*I. decora alba*), a member of the Legume Family, is the smallest species in cultivation of all the huge genus *Indigofera.* Strangely, the white form of the species, while relatively rare, has been available from limited sources, whereas up to recent years the species itself could not be found in cultivation either in the United States or Great Britain. In the summer of 1959, while traveling through Japan, I visited a small new botanical garden in Sendai. There, while walking through a rather uncultivated area, I noticed large drifts of the type species of this shrub with lavender-pink flowers. Inquiry confirmed that it was native to the area. During the following winter, through importation of a small division, it was introduced to my garden.

This deciduous shrub grows from 1 to 2 feet high and, in the white form, freely produces long racemes of pea-shaped white flowers in July and August. It prefers full exposure to sun and is most useful in the front of a shrub border, in a pocket of the rock garden or as a fine ground cover for a lean and stony slope. Its habit is to spread by underground runners, so a considerable area can be covered where space is available. Although current growth is killed back to the ground in winter, the shrub has proved completely root-hardy here. Many other species of *Indigofera* are tender in this northern climate.

Menziesia purpurea is a deciduous ericaceous shrub native to Japan. It is the finest and brightest-colored species in the genus, the bell-shaped flowers being outstanding with their bright wine-red corollas. Three species of *Menziesia* are native to North America, but none of them are impressive. The Japanese species and varieties are of greater beauty.

The nodding flowers of *M. purpurea,* produced in May and June in clusters of four to eight, resemble those of the more familiar *Enkianthus campanulatus.* But this *Menziesia* is a much smaller and slower-growing shrub, reaching 6 feet only after many years. The oldest specimen in my garden is now about 3½ feet in height and at least 20 years old.

This superb small shrub is relatively new in cultivation, having been introduced about 1914. Unfortunately, it is not commonly available, being slow from seed and often confused with other Japanese species, like *M. ciliicalyx,* whose flowers are of the same half-inch length. But the flowers of *M. ciliicalyx* usually vary in shades of pink. This species is an even smaller shrub, rarely exceeding 3 feet in height, and whether obtained under one name or another is a valuable addition to any garden that can accommodate ericaceous plants. Perhaps, with the increase in the skills of modern propagation, the rooting of cuttings will speed the availability of these choice species.

These acid-soil plants are cultivated with the same conditions as rhododendrons; that is, in moist but well-drained loam and peat. They may appreciate more sunshine than rhododendrons, provided the roots are shaded and moist.

SEVERAL YET-TO-BE-APPRECIATED FLOWERING SHRUBS

"Expeditions" to public collections will disclose unusual, worth-while plants for home grounds

Bernard Harkness

Grossman

Harlequin glory-bower (*Clerodendron trichotomum*) is colorful in both flower and fruit. It is much hardier than generally realized, growing well as far north as New York City. From eastern Asia.

PLANT collectors tend to be exclusive in the sense of devoting themselves to one group of plants primarily. This is understandable with the limitations of time, space and effort that one person can allot to a recreational activity. It is to the institutional collections scattered across the country that gardeners must go to see the broad spectrum of possible plants to add interest and novelty to their gardens. Being the curator of a living collection of a wide range of shrubs has led me to an appreciation of many which for various reasons have been overlooked and neglected in gardens. Each of the shrubs described here has one or more qualities to make it worthy of consideration for planting on the home grounds.

Harlequin Glory-bower

The pleasant aroma that fills the still air of a late August morning where Harlequin glory-bower (*Clerodendron trichotomum*) is grown has an exotic quality.

Grossman

Mint-shrub (*Elsholtzia stauntoni*) is noteworthy for its month-long bloom in early autumn. The tightly packed spikes are pale lavender. A twentieth-century introduction from northern China.

The plant is rather coarse and uncertain as to hardiness away from the coast north of Philadelphia. However, it persists and spreads underground even though it is killed back above ground. Flowering is on the current year's growth in clusters of many 5-petaled white flowers with reddish calyces which continue to enlarge and brighten in color after flowering to make a showy crimson backing to a quickly produced, blue fruit which ripens to black. It is not a shrub to bring to the fore, however, as the leaves, in contrast to the fragrant flowers, release an unpleasant scent when touched.

Mint-shrub

The stable performance of the mint-shrub (*Elsholtzia stauntoni*) gives it a reliableness which qualifies it admirably for landscape use. Not bold or showy, a little too much otherwise, perhaps, it nevertheless husbands its resources through summer storms or droughts to present through September its muted, lavenderish spikes at the tips of 2- to 3-foot stems. Though these stems do not live through the winter, the root has always been safely hardy. Leaves are pale green and tapering, about 4 inches long and with a pleasing, minty fragrance. Lists of autumn-flowering shrubs all give it a good billing, yet it has never seemed to reach many gardeners. It can easily be raised from seed.

Snow-Wreath

With the fleecy quality as if a white June cloud had dropped down, the Alabama snow-wreath (*Neviusia alabamensis*) has been grown in Highland Park, Rochester, New York for 65 years. In that time it has produced a wide clump of somewhat tangled stems which is probably the only way it might impress one. Its flowering effect depends entirely on masses of white stamens, no petals, in early June. For the rest of the year the plant is unobtrusive and might be taken for a spirea with reddish stems and alternate pointed leaves about two inches long. The dry fruits are surrounded by miniature leaves only making denser the green mass of the plant in autumn.

Prinsepia

The ever-admirable quality of hardihood is well claimed for the Mongolian prinsepia (*Prinsepia uniflora*). I am particularly impressed by its possibilities for a hedging that needs no barbering. It is a plant of northwest China. Two forms are now recognized, the first described, hence the typical form, has very narrow, entire leaves. The second form, variety *serrata,* not known by Alfred Rehder early enough to be included in his *Manual of Cultivated Trees and Shrubs,* has a leaf that widens out in the middle and usually has cut margins. Flowers are white and come early in the spring so as to make good pollination for fruits somewhat uncertain. It is one of the earliest shrubs to leaf out in the spring which, with a sprinkling of short spines along the branches, also recommends it for hedging. Branching is upright and ultimate expected height is about 5 feet. The fleshy fruits are wine-red in color.

Sargent Hydrangea

Boldness, a more entertaining quality in plants than in people, might be exemplified by a Chinese hydrangea discovered by E. H. Wilson in western Hupeh province and named in honor of Professor Sargent *Hydrangea sargentiana*. For the first 45 years it was grown in Highland Park, it was root-hardy only. It was appreciated nevertheless for its large hairy leaves (to 10 inches long) and the erect stems so closely covered with stiff bristles as to appear mossy. Recently it was found that by giving it a little winter protection in a walled courtyard, the stems would carry through the winter and give summer flowering of good-sized, flat blooms with pink sterile flowers surrounding a center of minute flowers attractively tinted bluish-lavender.

Genereux

Sargent hydrangea (*H. sargentiana*) is a bold-appearing plant with flower clusters combining pink and bluish lavender. Generally needs winter protection north of Zone VII (Virginia, Tennessee, and westward) in order to flower.

Himalayan Honeysuckle

An admittedly somewhat experimental shrub in upstate New York has an exotic quality that has charmed me. The Himalayan honeysuckle (*Leycesteria formosa*) must always be a die-back plant in this area, hence we shall miss having the contrast of its pea-green stems against the snow. Here it is a little slow to start in the spring and stem growth is about two feet in September when flowering begins. Long-tapered leaves to 5 or 6 inches in length are arranged opposite each other all along the stems. Flower petals are purple against handsome wine-red bracts which persist to back the red, finally black, juicy fruits. I greatly enjoyed some branches brought in before freezing last fall in order to ripen the fruits for seed.

Two Little-known Loniceras

An odd quality of unattainability seems attached to two honeysuckles but since, as a group, they are among the easiest to propagate from seeds or asexually, there seems no reason why gardeners should be deprived of them any longer. This is not a peculiar American astigmatism, as none of the standard English references list them either. Undoubtedly, their late introduction, both from Japan, in 1914 and 1915, accounts for their obscurity. Both shrubs have the merit, especially among honeysuckles, of maturing to plants about 6 feet in height.

I would promote *Lonicera demissa* (no English names are yet proposed) for its admirable display of fruits. These are scarlet, small in size, but every year produced in lavish abundance. Full color is reached by the end of August and the shrub is handsomely decked all through September. Small white flowers, necessarily also abundant, come in mid-May, then turn yellowish in aging. The shrub is dense with many small branchlets, small, oval, gray-green leaves. It makes a useful background shrub while its early autumn fruiting is awaited.

Lonicera tenuipes, which Japanese botanists now prefer to call *Lonicera gracilipes* var. *glandulosa,* is recommended for its early flowering of light red blooms

(*Concluded on page* 63)

Plants are but one element in

LANDSCAPE DESIGN

John D. Milliken

LANDSCAPE design might well be called the art of composing a succession of experiences for people. Its basic elements are land, structures and plants.

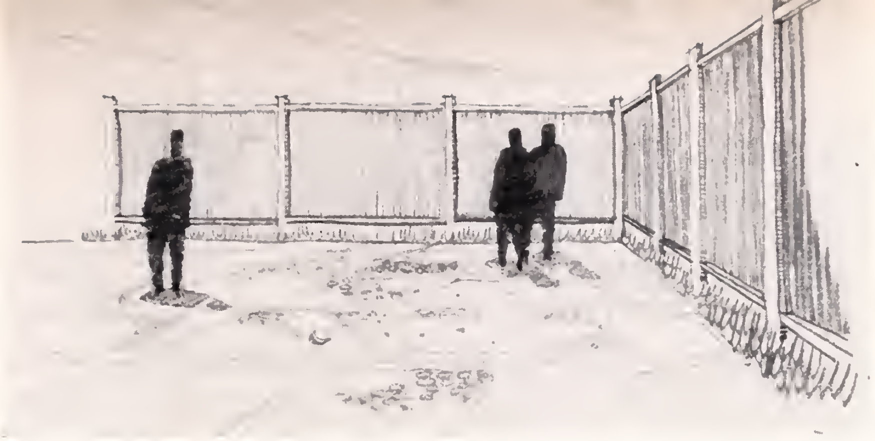
It is often unfortunate that so many of us have such an intense interest in plants. This tends to discount the importance of the other elements. Successful landscape design can derive only from the careful moulding of all elements into a harmonious total composition.

Observe people walking through a garden. How do they proceed? They tend to follow obvious lines or edges, and favor gentle slopes and level ground for pathways. A wall, the edges of a grove, the bottom of a steep slope, a water course are other examples of features in a landscape along which people tend to move. A multitude of observations about people and movement can hold direct implications for the landscape designer. As a person ascends a slope, for example, there is a greater consciousness of footing than is apparent where the path is on level ground. The urge to look down to be sure of one's steps means that delicate ground covers are likely to receive the attention their charm deserves. On level ground, they might be passed unnoticed. Paths and drives, if thoughtfully located, can derive advantage from the tendency of people moving along edges. They and the plantings adjacent to them then become appropriate to the composition.

As people traverse a landscape, sequences of spaces, views, forms or experiences occur along the path of movement. Each is related to the next and to the whole, and they need to be created so that there is total harmony among the elements of the design.

Even the casual observer is aware that groupings of homes of homogeneous quality occur in any city. The quality of the approach to such areas bears a direct relationship to the value of the areas themselves. The most beautiful homesite imaginable would be undesirable if it could be reached only by traversing the municipal dumping grounds. Any space must be not only of and for itself, but also a unit in a chain of related spaces. The driveway, street, block and neighborhood all affect the planting treatment of a single residential site.

Large trees and shrubs in bold sweeps would be needed for landscaping this area.



Herbaceous plants in small groupings, with a few medium-sized shrubs, would be appropriate here. Of larger shrubs, one or two at most would be sufficient.

Plants, as one of the three elements of landscape design, present one characteristic which provides a great variety of creative opportunities in design. This characteristic is the rapid and radical change that comes with growth, death and seasonal variations. Even hourly differences in shadow pattern and wind movements are to be considered for their effect on the composition. The play of a tree shadow on a wall or patio may well be just the element needed to evoke a tranquil mood in a quiet space. The same tree may provide cool shade in August but let welcome sun warm the patio in early spring and late fall, thus extending the usefulness of the area.

In making a selection of plants for a proposed design, certain general considerations limit the possibilities even before such specific factors as soil type, available moisture or sunlight are brought into play.

Scale is one of the first considerations. In the first illustration it can be seen that any planting in such a space must be composed of large trees and shrubs used in bold sweeps or masses. Single specimens of even the largest of trees would be grossly inadequate in such a setting. Conversely, in the next picture it is clear that one or two large shrubs would be sufficient for the space. Even medium-sized shrubs should be used sparingly. Herbaceous plants, in small groupings could, however, be appropriate in this restricted space. Because close inspection of each detail is invited here, richness of detail is imperative to the success of the area. Heavy masonry walls or planters of heavy lumber would be unsuitable. The lacy texture of a creeping cotoneaster would provide the kind of delicacy demanded in the space. Plants as well as all other elements should be in scale with the space in which they are used.

Character is a second consideration in plant selection. Where a highly refined planting is anticipated, such coarse-textured woody plants as sumac and witch-hazel are inappropriate. Similarly, the formal growth habit of many junipers, upright crab apples, or Japanese yews would be out of place where the situation called for naturalized plantings.

Simplicity is perhaps the most difficult design consideration to honor. Through years of gardening experience, homeowners often come to know and love a great many plants; their effort becomes one of nurturing a miscellaneous collection for the sake of the plants themselves, rather than for each plant's contribution to the composition as a whole. One of the keys to simplicity in planting design is a ruthless eraser during the planning process. A few species used in varying ways will heighten the clarity and unity of the composition.

The landscape designer must never attempt merely to create beautiful scenes but must strive to design experiences for people. Plants, used with restraint, are one of the tools in this effort.

SHRUBS IN A NATURALISTIC LANDSCAPE

Native plant selections for the northeastern states

Arthur T. Viertel

THE intent when planning a naturalistic planting is generally to idealize nature by trying to express its visual essence in a well composed way. This may be done realistically by straightforward interpretation, or the approach may be strongly stylistic in the fashion of other art forms, as is done in Japanese gardens. Contrary to customary thinking, the intent is seldom to duplicate nature exactly. At best, this would be manifestly difficult if not impossible.

There are many types of natural scenery which may afford inspiration for naturalistic, man-made landscapes. In accordance with the site to be developed one may, for example, try to capture the essence of a forest, an alpine meadow, a bog, a wild seashore, a woodland glade or a desert. Even the natural aspects of the pastoral countryside may provide ideas.

Composition in the Landscape

In gaining inspiration from nature, the plantsman-creator must be conscious of compositional effects. The distribution of scattered plants in an open meadow is usually not worthy of study. While nature is irregular, those natural scenes which attract do have a degree of order. This is not surprising when the factors responsible for local plant distribution are understood. For example, a sudden change in topography may cause abrupt changes in growing conditions and result in a rapid transition from one type of growth to another. Topography and plants are thus visually wedded. Wind direction or gravity may scatter seeds from a parent plant in a pattern which, through new growth, reflects the orderly forces involved in their distribution. Competition for light may cause orderly tiers of plants. Those requiring most light must either win the battle of height or grow on the edge of a mass or in the open. Those requiring less may survive at a lower level and those adapted to a minimum of light may be lower still. The factors involved in bringing about visual order in natural plantings are endless.

Successful naturalistic plantings are usually made with native materials or those which look as though they might be native. They are appropriate if the viewer can believe in the integrity of the scene in comparison with free nature as he is accustomed to it. This is true whether the scene being created is in a natural setting or away from it.

Native *and* Ornamental

One factor which has mitigated against the general retention or planting of native species is the term *ornamental plant.* This is a poor phrase because it suggests some undefined magical quality in a plant that makes it worthy within any developed area. By inference, in many people's minds it pits *native plants* against *ornamental plants.* This has resulted in the frequent planting of exotics in places where they are not appropriate. Take, for example, almost any large lake which, because of its forested shores, has delighted people and attracted them to build cottages. It is surprising how many owners eradicate most of the vegetation, develop polished lawns, and carve out flower borders. If woody plants are introduced, they are most likely to be horticultural niceties associated with city homes. In short, here there is no sympathy for the natural landscape, and the country grounds become echoes of city residences. This approach, repeated in other types of rural development, results in a tendency toward sameness throughout the countryside. Often, the very landscape which attracted people to an environment is thoughtlessly erased.

With few exceptions, almost any plant is ornamental in the right spot. While many natural associations contain some showy bloom for brief intervals, such show is the exception rather than the rule. Thus, certain locations in the Appalachian woodlands may appear to be on fire in spring with the flame azalea (*Rhododendron calendulaceum*) and also have a flurry of bloom on other azaleas, on flowering dogwood (*Cornus florida*), mountain-laurel (*Kalmia latifolia*), the American redbud (*Cercis canadensis*), the rosebay rhododendron (*R. maximum*) and others, as well as the shadblow or serviceberry (*Amelanchier canadensis*). However, if one drives through these mountains at most seasons, very little bloom other than roadside flowers is in evidence, and even in spring the number of views containing showy flowers is not great. The bulk of the woody growth is of less conspicuous species, although there is subtle charm, in fact much beauty, in the environment as a whole. The point being made here is that the beauty of nature, which is in large measure due to vegetation, is not usually due to bloom. The Japanese realize this. While their gardens are often associated with flowering cherries, the lasting qualities which attract are due to more subtle factors such as form, texture, subdued color harmonies and contrasts, compositional relationships, and the approval of the viewer as to the fitness of the materials used. The sensitivity in choice of plants which guides the Japanese is equally important in any naturalistic planting whether realistic or stylistic.

Roche

In wet areas, buttonbush (*Cephalanthus occidentalis*) will grow and spread. The late-summer ball-shaped flowers are cream-colored.

Roche

Highbush blueberry (*Vaccinium corymbosum*) is a worthy shrub for flowers as well as fruits. Leaves in autumn are rich red.

Natural plant associations usually contain a restricted number of plant species. Ecological factors such as frost, wind, salt spray, shade, moisture and soil type, acting singly and in concert, limit types of plants which will grow on any one site. Usually, a limited number of species dominates a scene, while a scattering of a larger number completes the association. The visual effect is generally one of harmony through repetition supplemented by variety. This is diametrically opposed to the collection idea and should be borne in mind when a naturalistic planting is being planned.

Brief comments on a restricted list of 25 varied genera containing native broad-leaved shrubs which are useful for naturalistic plantings are given below. Any selection of these should be used only with the above thoughts in mind.

For Sites with Acid Soil

The gardener whose grounds support acid-loving plants is fortunate, for some of the handsomest of the native shrubs demand an acid soil.

Aronia. Black chokeberry (*A. melanocarpa*), generally under 4 feet high, and red chokeberry (*A. arbutifolia*), to 6 feet or more, both have white flowers, excellent dark green foliage and brilliant red fall color. Moist soil is best for them, in either sun or shade.

Clethra. Summersweet, also called white-alder or sweet pepperbush (*C. alnifolia*), is irregularly upright (rarely to 10 feet), with bright green foliage and, in midsummer, spires of fragrant white flowers. It grows naturally in wet places, frequently in shade, but assumes a more regular form in sun on normally drained land.

Comptonia. Sweetfern (*C. peregrina*) is a twiggy plant, seldom above 3 feet high, with aromatic fernlike foliage. An excellent ground cover for clearings, open woods, and dry, sandy ground.

Gaylussacia. Black huckleberry (*G. baccata*), is a fine-textured shrub to 3 feet high with amber-green foliage, small reddish tubular flowers, and small seedy black fruits. It is suited to dry or moist sites in either full sun or partial shade, as in open woods or at woods edges.

Kalmia. Mountain-laurel (*K. latifolia*) is a medium to large evergreen shrub with showy rounded clusters of pink or white flowers in late spring or early summer. It makes a fine specimen plant, its leaves remaining glossy green the year around. Sheep-laurel (*K. angustifolia*), 2 feet high or less and smaller in all its parts, can be used as a ground cover. It too is evergreen; the flowers are of a more intense pink.

Rhododendron. Besides the evergreen rhododendrons, this group includes the native azaleas. There are species with white, pink, red, orange, yellow and lavender flowers. Most have branching patterns that commend them for the winter scene. Nearly all do best in dappled shade.

Vaccinium. Blueberries are of many sorts. All have small, waxy, whitish, urn-shaped flowers, and the commonly planted sorts have excellent fall color. Highbush blueberry (*V. corymbosum*) grows in sun or shade and prefers some moisture; lowbush blueberry (*V. angustifolium*) is a good ground cover for dry sites in sun or shade; the dry-land blueberry (*V. pallidum*, also known as *V. vacillans*) thrives in ground where moisture is lacking and grows to 3 feet tall.

In addition, *Ilex verticillata* and *Spiraea tomentosa* both grow best in acid soil but do not require it.

Plants for Wet Soil

Where a running stream, lake shore or

McFarland

Sweet pepperbush (*Clethra alnifolia*). Fragrant spikes of white flowers in late summer; yellow foliage in autumn.

Roche

Spicebush (*Lindera benzoin*) has delicate yellow flowers in early spring, long ahead of the leaves.

a lowland area keeps the ground constantly moist, certain plants will thrive, whereas others cannot tolerate so much wetness. *Clethra*, an acid-soil plant, can take it; so can *Cornus stolonifera*.

Cephalanthus. Buttonbush (*C. occidentalis*) is a large coarse shrub with spherical pincushion-like heads of creamy flowers 1½ inches across. Restricted to wet sites, where it may reproduce freely.

Ilex. Hollies do not all have spiny, stiff, evergreen leaves and red berries. Inkberry (*I. glabra*) has fine-textured, slender, shiny evergreen leaves, on wandlike upright stems bearing black berry-like fruits. Black-alder, also called winterberry (*I. verticillata*), is a slightly taller deciduous species with small bright red fruits on the female plants. Both prefer some moisture but stand drier sites and both prefer sun but stand some shade.

Plants for Moist but Well-drained Soil

While soil moisture is important to these plants, drainage is a greater need. The swamp rose (*Rosa palustris*) is one of these. (For wild roses in general see Sun-loving Shrubs, page 22.) Others for moist soils are these:

Chionanthus. White fringe-tree (*C. virginicus*), is a very coarse-textured shrub (sometimes a tree) with profuse clusters of gossamer-like white flowers. On female plants, these are followed by loose clusters of blue fruits.

Lindera. Spicebush (*L. benzoin*) is a large shrub which commonly grows in moist but well-drained shady places. It has smooth foliage, yellow fall color, and cheery though inconspicuous yellow flowers before the leaves in spring. These are followed by red berries close to the branches on female plants.

Spiraea. Hardhack or steeple-bush (*S. tomentosa*) is a 3-foot shrub with spires of deep pink flowers in late summer. Leaves are woolly-felted beneath. Best planted in the open, preferably in moist low ground in acid soil. Meadow-sweet (*S. latifolia*) is a slightly larger, more widely branching shrub with handsome spires of creamy-white flowers and thin smooth leaves. It also grows on drier sites.

Staphylea. Of the several species of bladdernut, only one, *S. trifolia*, is native to the

Roche

Bayberry (*Myrica pensylvanica*) offers fragrant grayish foliage in contrast to the green of other plants. Its waxy berries are decorative from late summer through winter, and are used in making bayberry candles. It thrives in dry soil.

eastern United States, but all of them have the same general landscape value. They are multi-stemmed upright shrubs 12 to 15 feet tall with nodding clusters of half-inch white flowers followed by sizable inflated bladder-like fruits. Sun or partial shade will do, and any normal soil; but a moist and well drained site is best.

Where Trees Give Shade

While some plants do best in shade (See *Lindera* under Plants for Moist but Well-drained Soil and *Rhododendron* under Sites with Acid Soil), many others grow as satisfactorily within the shadow of trees as in the open. The edge of the woodland where they receive some shade, some sun, is often ideal for such shrubs as these:

Ceanothus. New-Jersey-tea (*C. americanus*) is useful for dry situations in sun or open woods. It remains below 3 feet; has dark-green foliage and pleasing clusters of minute white flowers in summer.

Hamamelis. Witch-hazels display their flowers when the branches are bare of leaves. *H. virginiana* has yellow flowers with four straplike petals in latest fall. It is a tall shrub, usually wide-spreading, open and irregular in shade, more compact in sun. It stands dryness. Vernal witch-hazel (*H. vernalis*) has yellow to reddish flowers in earliest spring. It prefers more sun and moisture, is medium-sized and compact, with markedly upright branches. It suckers freely. Both species have yellow fall color.

In addition, a number of viburnums tolerate shade; mountain-laurel (*Kalmia latifolia*) also, though its bloom will be less. For other plants that can be used in shaded or part shaded situations, see *Aronia*, *Clethra*, *Comptonia* and *Vaccinium* under Sites with Acid Soil; also *Lindera* under Plants for Moist but Well-drained Soil.

Dry-soil Plants

Plants which tolerate dry soil are a boon to gardeners whose land is not naturally well watered. Besides those mentioned here, see *Gaylussacia* and *Vaccinium pallidum* under Sites with Acid Soil, *Ceanothus* and *Hamamelis* under Where Trees Give Shade, and *Rhus* under Sun-loving Shrubs.

Diervilla. Bush-honeysuckles are excellent as ground covers where a rather coarse plant is suitable. The southern species (*D. sessilifolia*), which grows to 4 feet, has fairly showy bloom. It is good for sunny slopes in well-drained soil as far north as central New York. Dwarf bush-honeysuckle (*D. lonicera*) is a smaller, hardier species. It does best in sun, but will grow in some shade. The flowers of both are yellow.

Myrica. Bayberries provide a change from the constant green of most shrub foliage. Northern bayberry (*M. pensylvanica*) bears dark olive-green, semi-persistent, aromatic leaves and gray waxy berries in tight clusters. It is a stiff shrub with upright stems, tall in shade but low on exposed coastal beaches. Sweetgale (*M. gale*) is a bushier shrub with pale bluish-green leaves on upright wandlike stems. It is usually found in sun near water, often on acid soil.

Sun-loving Shrubs

While most shrubs can grow in part shade, full sun is a necessity for others. Prominent among them are sumacs and roses.

Shadbush or shadblow (*Amelanchier canadensis*) is an adaptable plant that seems to grow well in any situation. The white flowers are conspicuous here and there in eastern woodlands in early spring.

Roche

Taloumis

The informal branching habit of beach plum (*Prunus maritima*) makes it particularly suitable for naturalistic landscapes in coastal areas of the Northeast, where it is native.

Prunus. Cherries and plums all prefer sun, but are otherwise not particular. Beach plum (*P. maritima*), sand cherry (*P. pumila*), Canada plum (*P. nigra*), American plum (*P. americana*), and the common choke cherry (*P. virginiana*) all have a worth-while display of flowers as well as generally edible fruits.

Rhus. Among the native species, fragrant sumac (*R. aromatica*) is the lowest growing, from 2 to 6 feet high, and does well as a cover on banks. The taller species make good drifts or thickets. All have brilliant fall color.

Rosa. Wild roses often require no particular care, provided they receive plenty of sun. This makes them especially appropriate for the naturalistic landscape. The prairie rose (*R. setigera*), with long arching canes, is good for bank cover; the Virginia rose (*R. virginiana*) is an upright, suckering, thicket-forming, shiny-leaved plant to 6 feet high; swamp rose (*R. palustris*) is somewhat like *R. virginiana* but has dull leaves and grows in wet places; Carolina rose (*R. carolina*), also resembles *R. virginiana* but is dull-leaved and below 3 feet in height.

For plants which can tolerate shade as well as sun, see *Clethra, Ilex* and *Sambucus*. Many other plants which do well in sun will grow in shade, but will not bloom or fruit as well and they may become sparse and spindly.

Shrubs that are Not Particular

There are a few shrubs that will fit into almost any situation: sun or shade, dry or wet soil, as long as the ground is well drained.

Amelanchier. Serviceberries are covered with short-lived white flowers before the leaves appear in spring. In June come small reddish to dark purple edible fruits, which the birds are likely to find first. *A. stolonifera* is a suckering shrub which forms colonies and usually grows 3 to 4 feet high. *A. canadensis*, in contrast, is a tall clump-forming shrub with many upright stems. Both will stand coastal conditions.

Cornus. Dogwoods of the shrubby species are numerous and all are excellent, though they bear scant resemblance to the flowering dogwood trees. The small flowers, which are in flat creamy clusters, are followed by berries of white, blue, black or red. Several species, among them red-osier dogwood (*C. stolonifera*) have stems colored red, yellow or green. Fall foliage is often conspicuous.

Sambucus. Elderberries are coarse, weak-wooded shrubs to 12 feet high. American elder (*S. canadensis*) has large flat clusters of creamy-white flowers followed by purplish-black fruits which are edible. Scarlet elder (*S. pubens*) and also European red elder (*S. racemosa*), have pyramidal clusters of flowers and inedible red fruits.

Viburnum. Viburnums include many excellent species. All native ones bear creamy clusters of flowers, have good fall color, and decorative fruits of blue, black or red. Maple-leaf viburnum (*V. acerifolium*) and hobblebush (*V. alnifolium*) are outstanding plants for shaded situations. The latter as well as withe-rod (*V. cassinoides*) do best in acid soils. Others are not particular.

Genereux

Viburnum wrighti often grows to 6 feet or more. In a lower, compact growing variety (above), the autumn display of leaves and fruits is intensified.

AUTUMN FOLIAGE AND FRUITS

Buds and branching patterns also among off-season attractions of choicer shrubs

Gordon E. Jones

SHRUBS for landscape planting are too often chosen solely on the merits of their flowers, whose display is generally of short duration. But each plant remains as part of the landscape picture all year long. Unless it can be admired at other seasons, too, its role in the garden scene is a minor one.

Deutzias and lilacs, for example, are cherished when in flower but after the bloom is gone these shrubs are relatively uninteresting. This is not to say that lilac and deutzia should not be planted, but rather that they should be sparingly used, especially in small gardens. Preference might better be given to plants with evergreen foliage, autumn coloring, ornamental fruits, even distinctive bark or branching habits, as well as attractive flowers.

Deciduous Shrubs

Several choice deciduous shrubs can bring to garden plantings attractive spring flowers, neat summer foliage and vibrant fall colors before the leaves drop and reveal the often interesting pattern of bare branches. Those that are mentioned here are but a sampling of the possibilities.

Enkianthus

Of special merit is the redvein enkianthus (*E. campanulatus*). The flowers can be best enjoyed where they can be viewed intimately, as just off a patio or terrace. The foliage turns brilliant scarlet and orange in the fall.

Not easy to find in the nursery trade but well worth searching for is the white-flowering *Enkianthus perulatus,* a more compact, lower-growing, rounded shrub that is even more striking in its fall foliage display.

Azaleas

Among the deciduous azaleas there are a number of fine native species and hybrids that are of real value in garden planting because of their spring bloom and colorful autumn foliage. Of the native species our pink-shell azalea (*Rhododendron vaseyi*), the royal azalea (*R. schlippenbachi*) and the sweet azalea (*R. arborescens*) are particularly handsome in both spring and fall.

The Knapp Hill and Exbury hybrid azaleas, introduced in recent years from England, offer marvelous flower colors: clear bright yellows, oranges, pinks and reds. When grown in open sun or in lightly shaded areas, many of these fine hybrids also stage a brilliant autumn foliage show.

Fothergillas

Another group of shrubs well worth an effort to locate contains the three species of *Fothergilla. F. major* and *F. monticola* are both upright, rounded shrubs growing ultimately to 6 or 8 feet. There is a noticeable similarity to the related witch-hazels in habit of growth and leaf-shape. If planted in the open or in only lightly shaded locations, the leaves turn to brilliant yellow and scarlet in the fall. These two species are similar

The pattern of branches and leaves on rockspray (*Cotoneaster horizontalis*) is one of the charms of this well-known sprawling shrub.

Gottscho-Schleisner

in appearance, the flower spikes of *F. monticola* being slightly larger when they open in mid-May.

For small gardens and foundation plantings, the dwarf fothergilla is an invaluable plant (see page 11). The leaves become bright yellow and scarlet in the fall.

Oakleaf Hydrangea

The bold reddish-purple autumn tones of the oakleaf hydrangea (*H. quercifolia*) make this southern native worth growing for its foliage color alone. The large leaves are lobed much like oak leaves; the plant becomes 3 to 4 feet high and wider spreading. It is best used by itself or with other large-leaved plants, preferably in an open, sunny location, although it will grow well in considerable shade. The large white flower clusters last from midsummer through autumn and turn purple with the leaves.

Cotoneasters

For foliage texture, habits of growth and bright-colored fruits, some of the cotoneasters are among the choicest of shrubs for landscape use, even though in bloom they are not conspicuous.

Rock cotoneaster, or rockspray (*Cotoneaster horizontalis*) exhibits a fishbone pattern in its branching, a characteristic that marks it as it rambles over rocks or lies against a wall on which it has been trained. Its leaves are tiny and glossy green; its abundant fruits are bright red in the fall. A miniature rockspray called 'Little Gem' is ideal where a small rock-loving plant is desired.

Early cotoneaster (*C. adpressa praecox*) is a most attractive mound-shaped

McFarland

Large bright-red fruits are borne in profusion on early cotoneaster (*C. adpressa praecox*).

The nearly horizontal branches of the doublefile viburnum (*V. plicatum tomentosum*) give this large flowering shrub a distinctive quality throughout the year.

Gottscho-Schleisner

shrub not over 18 inches tall. Particularly notable are its small glossy deep-green leaves and its large showy bright-red berries in autumn. Taller growing, making a broad shrub 5 to 6 feet high, the spreading cotoneaster (*C. divaricata*) becomes a handsome specimen plant when placed where it can develop well and be admired for its arching branches of small leaves and its bright red fruits.

Viburnums

Large in numbers to choose from, the viburnums are valued for their flowers, foliage and fruits, which give them year-round attractiveness.

One of the largest, almost a tree-like plant, is the Siebold viburnum (*V. sieboldi*). Its one drawback is that the foliage when crushed or brushed against is strongly ill-scented. But if placed where the objectionable odor is not noticed, it can be enjoyed as one of the handsomest of the viburnums. Its interesting branching habit, large bold lustrous green leaves, and its many flat clusters of creamy-white flowers in May, followed in summer by early-ripening bright red fruits on red stalks, are all assets of real worth.

The doublefile viburnum (*V. plicatum tomentosum*) also requires much space, for the long branches are horizontal and they clothe the plant to the ground. The broad flat flower-clusters (mid-May) are ringed with showy sterile flowers; the remaining flowers, which are small and fertile, develop during the summer into berries, first red, then black. Fall foliage is reddish purple. The Japanese snowball (*V. plicatum,* long known as *V. tomentosum sterile*) is a non-fruiting viburnum with showy rounded clusters of sterile flowers.

The tea viburnum (*V. setigerum*), upright in habit, is one of the most colorful

Roche

Viburnum wrighti. Two portraits: creamy flowers in May, scarlet fruits and purplish foliage in October, as in its native Japan.

of all fall-fruiting shrubs. Two other fine species having colorful fruits are the linden viburnum (*V. dilatatum*) and the Wright viburnum (*V. wrighti*). Both are rounded, 6- to 8-foot shrubs, dense in habit and covered with flat clusters of creamy-white flowers late in May. Deep crimson berries and reddish-purple autumn foliage follow.

Broadleaf Evergreens

There are many fine broadleaf evergreen shrubs with foliage that persists throughout the cold months either in green or bronzy purple. Some of these are extremely valuable in acid-soil gardens as far north as they can be grown. Checking with local nurserymen is advisable to determine those known to be hardy in the area.

Carolina Rhododendron

A native American species of particular merit is the Carolina rhododendron (*R. carolinianum*). This is a relatively low, neat and small-leaved evergreen (the leaves about 2 inches long). The flowers range in color from white through clear pink to deep lavender-pink. Because of this variation, it is wise to select plants in the nursery when they are in bloom. The leaves of many plants, particularly if grown in sunny locations, take on an autumn tone of bronze. A new Carolina rhododendron hybrid, 'Peter J. Mezzitt' (known commonly as 'P.J.M.') is noteworthy for its compact habit of growth and handsome bronzy winter foliage.

Oregon Holly-grape

A native shrub from the Pacific Northwest, Oregon holly-grape (*Mahonia aquifolium*) has not been planted in eastern gardens as much as it deserves. If grown in partial shade with protection from the drying winds of winter, the glossy evergreen leaves turn to a lustrous bronzy-purple in the fall. (If unprotected, its leaves are likely to dry and fall.) When spring comes, spikes of small fragrant bright-yellow flowers cover the plants. In summer blue-black berries appear.

Glossy Abelia

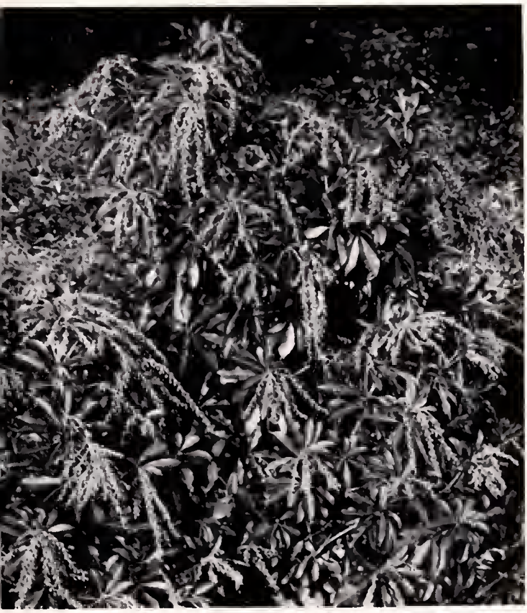
Few shrubs retain their landscape effectiveness for a longer period than glossy abelia (*Abelia grandiflora*). In the vicinity of New York City the plant remains evergreen, suffering tip die-back only in severe winters. Meanwhile, in regions where it is evergreen, the small glossy deep-green leaves take on a handsome rich bronzy tone in early autumn. The small, white, pink-flushed flowers appear from late June until snowfall.

Evergreen Barberries

In spite of the thorn hazard of barberries, there are several handsome evergreen species well worth a choice location if it can be where the plants will not be brushed by passers-by. The warty barberry (*Berberis verruculosa*), the paleleaf barberry (*B. candidula*), the Chenault barberry (*B. chenaulti*), and the less hardy three-spine barberry (*B. triacanthophora*) are all fine evergreen shrubs. They are low-growing plants with leathery evergreen leaves, white beneath and lustrous green above. Neat and compact in habit, each produces small golden-yellow flowers in May as well as blue-black fruits in the fall.

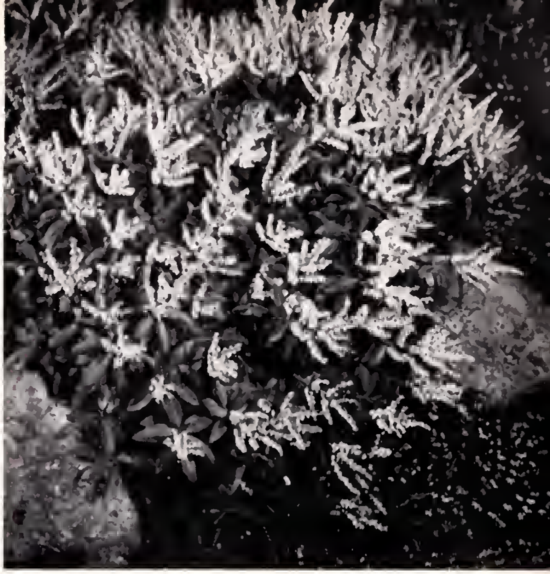
Evergreen Cotoneaster

The willowleaf cotoneaster (*C. salicifolia floccosa*) is a tall, gracefully arching shrub with glossy, narrow, evergreen leaves, clusters of white flowers in May or early June, and quantities of deep orange-red berrylike fruits in the fall. In severe winters plants may be defoliated; north of New York City this cotoneaster is not reliably hardy. For some choice deciduous cotoneasters, see page 26.



Gottscho-Schleisner

Pieris japonica. Its long-lasting and gracefully suspended clusters of flower-buds are formed in autumn. Blossoms appear in early spring. A native of Japan.



Genereux

Pieris floribunda, of the southeastern United States, bears its creamy flowers on upright stalks.

Pieris

Conspicuous flower-buds in pendulous clusters enhance the lustrous dark-green foliage of Japanese pieris (*P. japonica*), throughout the fall and winter. In April they open into lily-of-the-valley-like sprays. Soon afterward, the new terminal growth is seen, bearing young leaves of gleaming reddish copper. As soon as it matures, all the foliage remains glossy green the remainder of the year. The variety 'Dorothy Wyckoff' produces especially large flower clusters. More difficult to find but well worth seeking is the variegated form (*P. japonica variegata*), which, if given a lightly shaded location, is a handsome plant throughout the year. Hardier, yet sometimes not as easy to establish, is the southern Appalachian species *P. floribunda*. On this, the white flowers, resembling those of blueberries, stand in erect, rather ungraceful clusters.

How to achieve

THE BEST IN FLOWERING SHRUBS

Leslie Laking

THE successful culture of ornamental flowering shrubs has more than one point of beginning. The good gardener knows that intelligent selection of material which will adapt to the conditions at hand is quite as important as securing well-grown, freshly dug or at least properly handled plants. He knows too that proper planting and subsequent care do not take second place to either of the above.

To illustrate, we need only turn to the fragrant viburnums such as *Viburnum carlesi* or *V. carlcephalum*. Being grafted plants, and requiring to be handled with a ball of soil, well-grown specimens cannot be cheap shrubs. One must be willing therefore to pay for a good product. At the same time, it is useless to use any of these in a site that lacks good drainage, or that does not have at least half a day of sunlight. It is equally useless to leave such shrubs to their own devices without subsequent care, for the understock frequently suckers and vigorous growths from below the graft will overtop the shrub in one season. Such growths will take over in three to four years, overshadowing completely the expensive shrub originally planted, and eventually weakening it to the point of death.

While this discussion concerns flowering shrubs generally, it excludes special groups such as rhododendrons, which are treated separately.

Site Selection and Hardiness

When planning to introduce flowering shrubs to your garden, hardiness information available for the area should be consulted. Hardiness ratings of necessity must be generalized, hence they must be correlated with conditions existing in the particular planting site. For example, exposure to excessive winter wind will count against a shrub, as will imperfect or poor soil drainage, especially if the plant is near the limit of its hardiness range. The effect may be felt on the entire plant or only on the flower buds (*e.g.*, forsythia). In other words, hardiness concerns "unmeasurables" as well as response to minimum winter temperatures.

Selecting sites for shrubs is often a matter of selecting shrubs for the site at hand. If the location exhibits awkward peculiarities such as droughty soil, excessive shade, or considerable acidity, it is wise to select shrubs which are naturally adapted to such excesses. Otherwise the site must be altered to suit the plants in question. In many instances this may be possible, but it requires both understanding and effort. Ideal conditions for the vast majority of flowering shrubs include deep, well-drained soil, well supplied with organic matter, and located where the amount of sunlight approaches the two-thirds mark and where competition from large trees is at a minimum. This complex of ideal conditions is rarely found, hence one or more may require amendments.

Light conditions are usually most difficult to alter, hence plants should be selected with existing light ranges in mind. In the Northeast, for example, where fragrant viburnums are widely used and loved, it has been found that *Viburnum burkwoodi* will thrive better than others under reduced light.

Where soil is excessively moist, artificial drainage may be required. When the converse is true, deep trenching with compost, farm manure or peat, combined

McFarland

Korean spice viburnum (*V. carlesi*) planted where its fragrance can be enjoyed.

with surface mulching after planting, will vastly improve excessively dry soils with low organic content.

Season for Planting

Flowering shrubs which are handled with bare roots should be transplanted when dormant or nearly so. Those who garden in temperate climates have always known that springtime, before the buds burst, is a normal planting season. In more recent years, autumn planting has become much more common, and has produced good results. Two points favor autumn planting—naturally cooler and moister weather, and a general tendency for the gardener to have more time to do it properly. Those who object to autumn planting in general are those who garden in harsher climates.

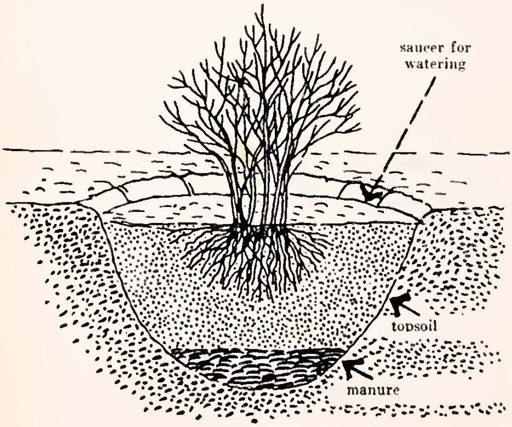
Container-grown shrubs, and those available as balled-and-burlapped specimens can of course be handled over a longer season.

Pre-planting Care

Shrubs which have come from a nursery should be given some thoughtful care, especially if they cannot be planted on arrival. These are not a bundle of sticks as they may appear—they are living plants! If freshly dug, and packed with moist sphagnum or the equivalent, and well protected from desiccation, they will stand for a few days without harm, if in a cool place away from sun and wind. Shrubs which are bare and only roughly wrapped, also those which have been in transit for some time, should be opened immediately upon arrival and examined. If dry, they will require attention. Soaking the roots and lower stems in water for a few hours will add moisture to the tissues. Afterwards they should be kept moist by "heeling in" or by wrapping in moist sphagnum or peat until ready for planting. The oft-recommended practice of heeling in shrubs in a moist shaded part of the garden is satisfactory provided an open area is available. Shrubs which are heeled in, are merely planted obliquely in a temporary fashion in a trench. Roots and lower parts of branches are covered with moist soil and firmed to exclude drying effects of the atmosphere. If they must remain heeled in for any length of time they should be covered with burlap and syringed occasionally with the garden hose.

Grossman

When setting out a shrub, dig a hole twice as large as the wrapped root ball or mass of roots. Note sketch below. If a shrub is balled and burlapped, as above, the wrapping needs only to be loosened and laid out in the hole beneath the roots, where it will disintegrate. Pack soil firmly around root mass.



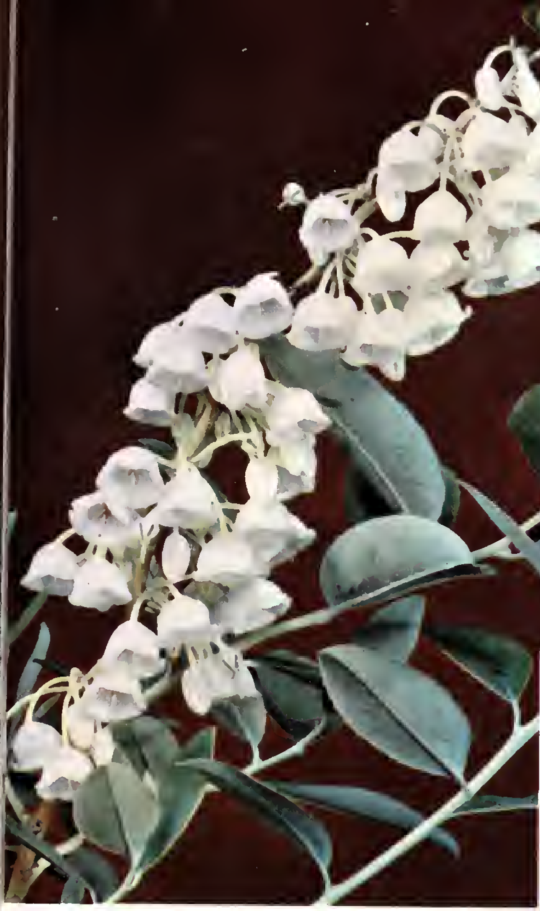
Planting a Specimen Shrub

The subsequent behavior of a shrub is often a reflection of the effort made at planting time. The techniques associated with reforestation are scarcely adequate. In other words, a slit with a spade, widened with a flick of the handle, the seedling dropped in and firmed with a heavy foot, will not do in the garden!

The following is a good method of planting a specimen shrub:

1. Dig a hole both deeper and wider than is required to accommodate the root system when spread out, or the ball of a container-grown or balled-and-burlapped shrub.
2. Keep sod (if any), topsoil and subsoil in separate piles.
3. Loosen the soil in the base of the hole, add organic matter in some form, including the sod inverted (if any).
4. Place a covering of topsoil in the hole and tread lightly.
5. Place the shrub in the hole, spreading the pruned roots of bare-root shrubs. For balled shrubs, the depth of the hole at this stage should be such that the ball can rest on the layer of topsoil, and end up at about the same depth as or slightly deeper than it grew in the nursery.
6. Add topsoil around the roots, making certain that it is in contact with bare or balled roots. Firm with heel or tamper.
7. Add more soil, including subsoil, leaving enough depression around the shrub to hold a bucket or two of water.

(*Concluded on page* 62)

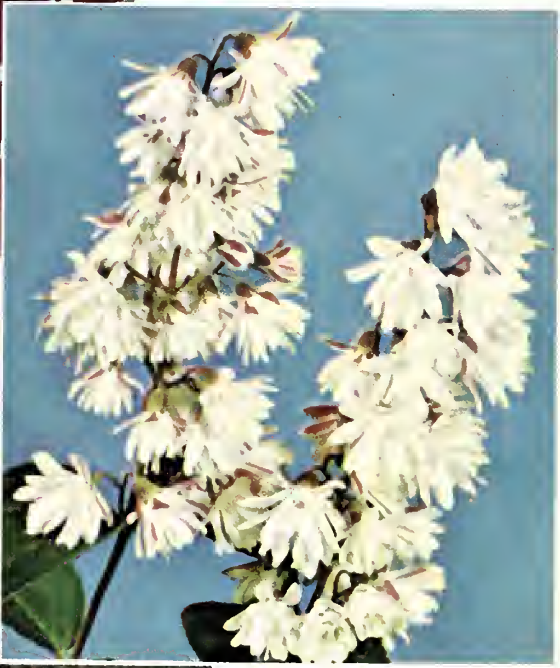


ZENOBIA
(Z. pulverulenta)

A native species in the southeastern U.S.A., where the foliage sometimes is evergreen, it can be grown north to Massachusetts. Half-inch white bells open among blue-green leaves in late spring or early summer.

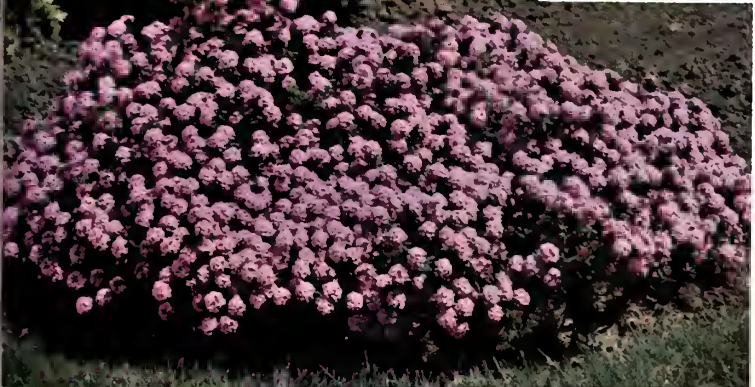
DEUTZIA ▼
(D. scabra)

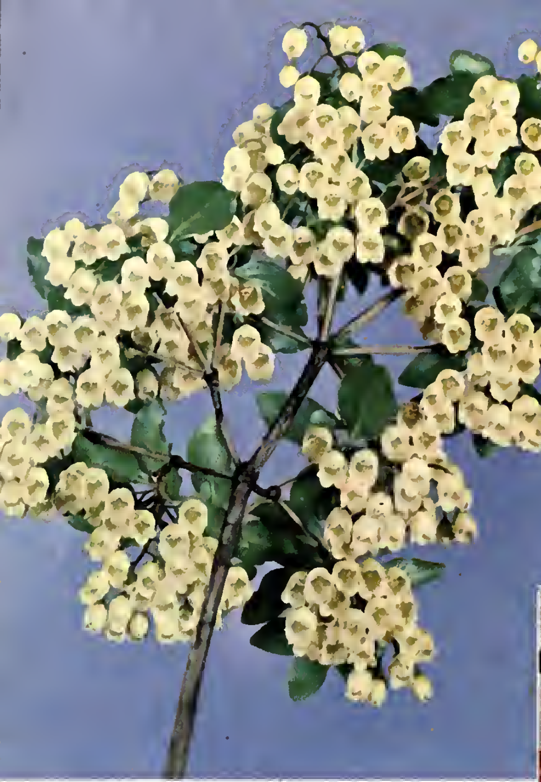
Double white flowers (sometimes pink or lavender tinted) are displayed in profusion in midsummer. This old-fashioned shrub is easily grown in almost any soil, under most conditions.



ROSE DAPHNE ▼
(D. cneorum)

A low-growing shrub that bears dense sweet-scented clusters of small pink flowers, early to mid-spring, with occasional sparse bloom again in summer. Good soil drainage is important for successful culture. Evergreen in mild climates.



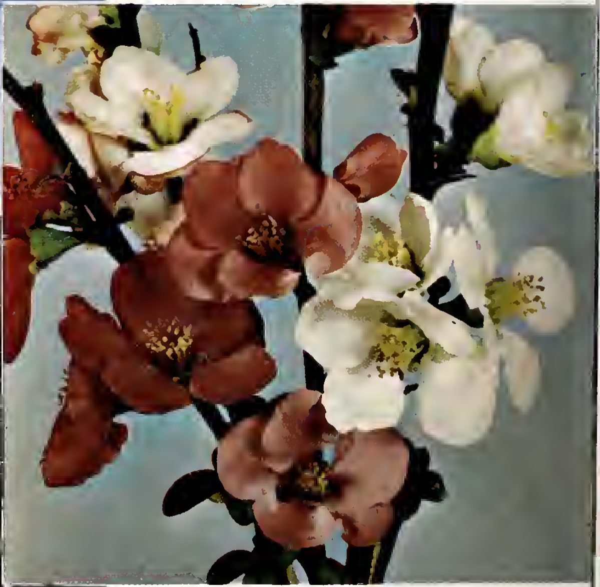


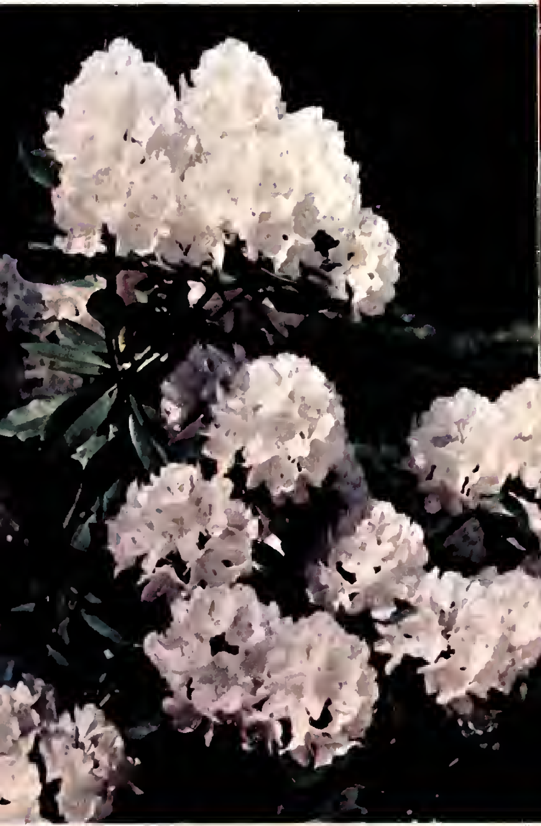
ENKIANTHUS
(E. campanulatus)

Ivory-colored bell-like flowers veined with pink dangle from stiff branches beneath the expanding young leaves. This tall, hardy shrub can stir interest in any garden. Foliage turns bright red in fall.

FLOWERING QUINCE ▼
(Chaenomeles lagenaria)

An easily grown shrub which flowers in early spring before the leaves. Available in many horticultural varieties. Shown here: 'Alba,' 'Appleblossom,' 'Atrococcinea.'





◀ RHODODENDRON
(R. album grandiflorum)

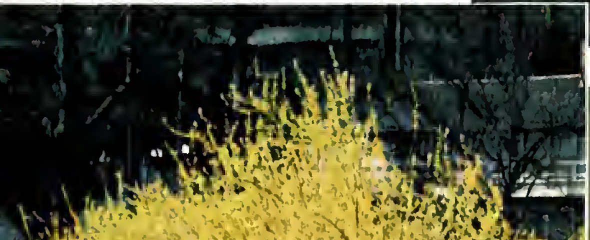
Evergreen foliage and large flower-clusters make the hundreds of varieties of rhododendron among the finest of spring-blooming shrubs. Acid soil and at least partial winter shade are the basic requirements. The variety shown here succeeds well in cold temperate climates.

BURKWOOD VIBURNUM
(V. burkwoodi)

In late spring, three-inch clusters of pinkish-white flowers at ends of branches give off gardenia-like fragrance. Fruits are black. Shrub is wide-spreading, with handsome leaves, brown-veined, which last well into winter. Partial shade suits it best.

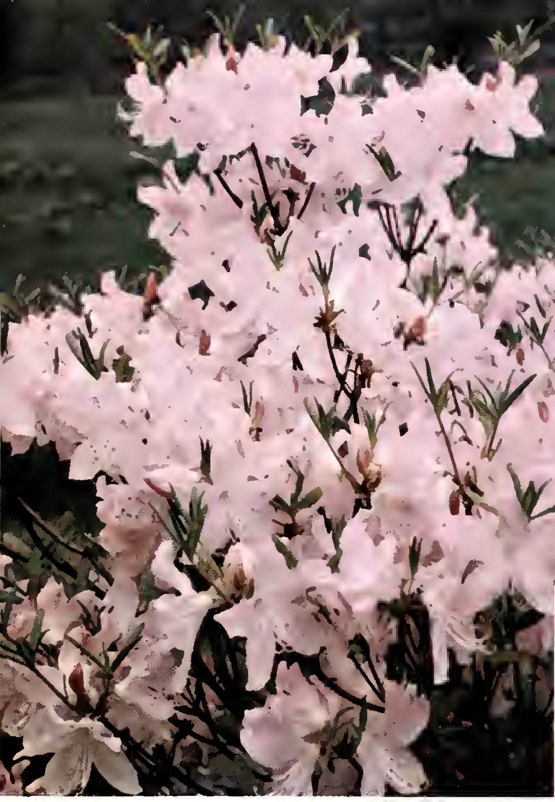
FORSYTHIA ▼

Official flower of New York City's Borough of Brooklyn is one of earliest spring-blooming shrubs, flowering before leaves appear. Available in numerous horticultural varieties of which the hybrid *F. intermedia spectabilis* is one of the handsomest.



JAPANESE PIERIS
(Pieris japonica)

An excellent broad-leaved evergreen shrub for areas with acid soil. Bears pendent clusters of waxy white flowers in early spring. Young leaves, which appear soon after, are glossy reddish-bronze. Often incorrectly called "andromeda," the generic name of bog-rosemary.

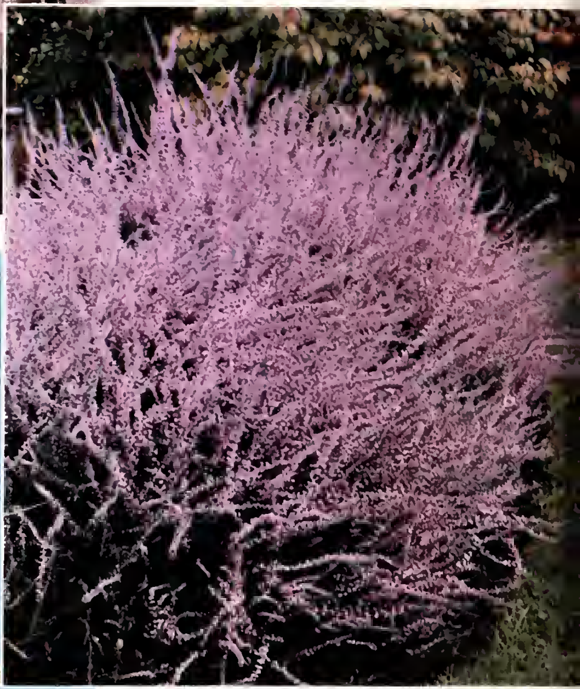


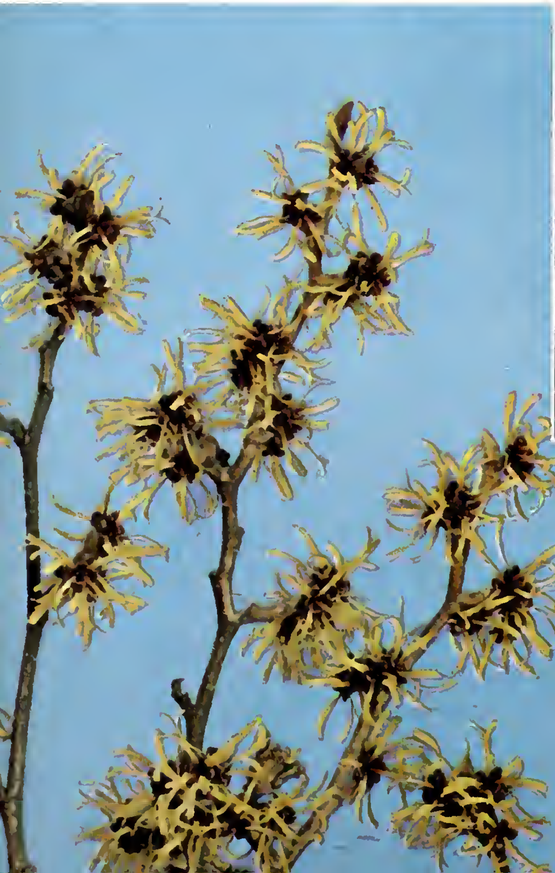
ROYAL OR PINKSHELL AZALEA
(Rhododendron schlippenbachi)

A floriferous shrub, its upright branches studded in mid-spring with fragile-appearing, fragrant, shell-pink flowers. Leaves turn a warm yellow and red in autumn. Thrives in acid soil.

HEATHER ▼
(Calluna vulgaris)

Masses of bloom on erect branches from late summer to fall last several weeks. Some of the many horticultural varieties are dwarf. Minute inconspicuous leaves are evergreen. An excellent flowering ground cover for acid soil, though clumps need occasional renewing.





◀ CHINESE WITCH-HAZEL
(Hamamelis mollis)

For bloom in late winter, this is the ideal shrub. Deserves greater recognition from those who seek unusual woody plants. Flowers are set close against the bare branches. Leaves turn bright yellow in late fall.

HOW TO PRUNE ESTABLISHED SHRUBS

Leslie Laking

THE more familiar one becomes with flowering shrubs, the more one feels that each species and cultivar has its own special characteristics of form and habit, requiring consideration at pruning time. This makes a horticulturist hesitate to give broad pruning recommendations except to advise against shearing. Yet there are fundamentals which can be a useful guide to pruning flowering shrubs.

Early-blooming shrubs produce flowers from buds which were formed during the previous growing season. For example, there is no difficulty in finding well-formed flower buds in August and September on such spring-flowering shrubs as forsythias, lilacs and the fragrant viburnums. These, and the great array of shrubs which bloom between April and June in the Northeast, will suffer from loss of flowering wood if pruned at any time other than immediately after the spring flowering period.

With most shrubs, some pruning is advisable immediately after spring bloom. To illustrate, *Viburnum carlcephalum* may require little or no regular pruning, but if it is getting out of shape, or somewhat too large for the place assigned to it, removal of unwanted wood, or heading back of the more vigorous shoots to good laterals can be done when the flowers have faded.

If forsythias are to retain a reasonable size, it is essential, immediately after blooming, to remove all old complicated-looking wood which has flowered for two seasons or more. This is primarily a wood-renewal or rejuvenating technique, and where possible wood should be removed from the base of the shrub. Whereas this method works also for many of the spring-flowering spireas and countless other shrubs of this type, it cannot be applied across the board. To illustrate, the beauty-bush (*Kolkwitzia amabilis*), if treated in this manner, would flower very sparsely. Quantities of twiggy growths are required before this shrub will bloom well. This explains its habit of not flowering freely until it develops considerable size and twigginess. It requires much less pruning, and only much older wood should be removed after flowering. Shrubs such as many of the cotoneasters, which are grown for autumn and winter fruits more than for their bloom, fortunately require much less pruning than do forsythias. When necessary, older wood may be removed after flowering or later in the summer, sacrificing some of the display of fruit.

A second group of shrubs flowering in mid- or late summer require different treatment, since they bloom on wood produced during the current season. This group is represented by *Caryopteris*, *Spiraea bumalda* cultivars and many of the common hydrangeas, including cultivars of *H. arborescens*.

These plants benefit from heavy pruning in early spring before growth begins. The previous year's shoots should be thinned, and the remainder cut back to within two to four buds of their origin. This has the effect of reducing the number of shoots, making them stronger and in turn inducing better bloom. Even this technique will produce usually more growths for summer bloom, than were there the previous year.

In this group there are exceptions too, because an August-flowering shrub such as *Hibiscus syriacus* requires little or no regular pruning. Such exceptions serve to emphasize the statement made earlier, that each plant has its own characteristics and its own response to pruning. Generalizations in pruning instructions are helpful but are no substitute for careful observation of the effect of pruning on individual shrubs and applying one's findings; nor is this any substitute for a good, strong, sharp pair of secateurs.

For more on pruning, see page 63.

FLOWERING SHRUB SELECTIONS FOR DIFFERENT PARTS OF THE UNITED STATES

ON this and the following pages, seven experienced horticulturists from different parts of the United States describe flowering shrubs that they consider particularly successful in their respective regions. Dependability, adaptability, and more-than-one-season attractiveness are the main criteria for inclusion here.

Many of the shrubs for the Northeast, Midwest and Rocky Mountain areas are as much at home in one region as another. And in the Southeast and Southwest, crape-myrtle, firethorn and bird-of-paradise bush are similarly successful. Likewise, several of the Northeastern and other regional selections will thrive in the North Pacific Coast area.

The versatility of such familiar shrubs as lilac, spirea, deutzia and mountain-laurel, which tolerate a wide climate range, gives them universal value.

Choices for the Northeast

Robert G. Mower

Forsythia ***Forsythia intermedia***

Outstanding Features: Yellow flowers on long bare branches in mid-April before there is much color in the landscape. Plants seldom troubled by insects or diseases.

Habit and Use: Upright and spreading, to 8 feet tall when fully grown. Foliage of medium size and texture; autumn color usually reddish purple but not outstanding. In a distant setting, its springtime bloom will show up adequately, and its rather coarse summer appearance will not be obtrusive.

Culture: Not particular as to soil, but needs sun. Pruning after flowering is necessary to keep growth under control.

Varieties: 'Spectabilis,' with more abundant bloom and with flowers of deepest yellow; 'Beatrix Farrand' and 'Lynwood Gold' with larger flowers; 'Spring Glory' with large flowers of pale yellow.

Other Species: Drooping forsythia (*F. suspensa*), with broadly arching stems that often touch the ground; good on banks or hanging over walls, but with less abundant bloom. Early forsythia (*F. ovata*), also with less showy flowers but with flower buds less liable to injury from low temperatures over winter. (Also called Korean forsythia.) Forsythia 'Arnold Dwarf,' excellent as a hanging plant or as a ground cover.

Lilac ***Syringa vulgaris***

Outstanding Features: Large clusters of fragrant single or double flowers from pale lavender to purple, also pink or white, in spring. Hundreds of named varieties available for landscape use.

Habit and Use: Plants grow to 20 feet. Foliage is clean and smooth though sometimes subject to mildew, which may be checked by application of a fungicide. Best as a large specimen shrub or in a group with other lilacs.

Culture: Sun and well-drained soil required. Pruning and fertilizing every second year will give better bloom.

Removing spent flower clusters also helps to promote good annual flowering.

Other Species: Chinese lilac (*S. chinensis*), a more graceful, slightly smaller plant with smaller leaves and denser habit, elongated drooping clusters of generally rose-purple flowers in late May. White and paler colors also available in several named introductions.

Korean Spice Viburnum
Viburnum carlesi

Outstanding Features: Handsome fragrant white flowers in mid-May opening from red buds; later, clusters of blue-black fruits and velvety red autumn foliage.

Habit and Use: Seldom over 5 feet tall, rounded in outline, but not dense. Summer foliage gray-green, leaves oval, to 4 inches long. The scent makes this plant a pleasant one to place near a doorway.

Culture: Sun and ordinary soil. If greener leaves of slightly different character appear, it means that suckers are arising from the understock, on which the plants are usually grafted. These suckers should be immediately removed.

LILAC 'VESTALE' (*Syringa vulgaris* hybrid)

Roche

DEUTZIA (*D. gracilis*)

Deutzia ***Deutzia gracilis***

Outstanding Features: A low-growing, neat and dainty plant bearing a mass of small white flowers in May.

Habit and Use: Rounded in outline and dense in growth with many slender branches from the base. Suitable in front of larger shrubs, as a border by itself, or as a small specimen plant.

Culture: Sun and ordinary garden soil. In colder areas tips may be damaged in winter and will need to be pruned off in spring.

Other Kinds: *D. lemoinei* 'Compacta,' a dwarf form of a hybrid deutzia, is even smaller. See also *D. scabra* on the first color page.

Spirea ***Spiraea vanhouttei***

Outstanding Features: Arching branches covered with umbels of small white flowers in May.

Habit and Use: Graceful small-leaved shrub usually 4 or 5 feet tall, the arching branches longer. Subject to overuse, but a valuable addition to the garden scene if planted sparingly.

Culture: Sun and ordinary garden soil. The plant has no serious cultural, disease or insect problems.

Other Species: Bridal-wreath (*S. prunifolia* 'Plena'), slightly taller with irregularly arching branches and an abundance of long-lasting small white double flowers. Its small slender

Genereux

SPIREA (*Spiraea vanhouttei*)

Genereux

BRIDAL-WREATH (*S. prunifolia* 'Plena')

leaves turn rich red or orange in the fall.

Mock-orange
Philadelphus coronarius

Outstanding Features: Strong fragrance combined with attractive flowering. Masses of four-petaled white flowers in June. There are also double varieties.

Habit and Use: Dense and vigorous shrub to 10 feet tall, needing a spot by itself where it has ample room. Yellow autumn foliage.

Culture: Sun and ordinary garden soil. Prune after flowering.

Other Varieties: A hybrid group called *P. lemoinei* contains several varieties growing not above 5 feet: 'Avalanche,' 'Boule d'Argent,' 'Candelabre,' 'Mont Blanc' are among them. They bloom slightly earlier and are less hardy.

Catawba Rhododendron
Rhododendron catawbiense

Outstanding Features: Evergreen shrub of marked hardiness, bearing abundant flowers in May or June, according to region and climate.

Habit and Use: To about 6 feet. Leaves glossy above, whitish beneath. A disadvantage is its off-purplish flower color, difficult to blend with other flowers. But see varieties mentioned below. Catawbas are fine among other broad-leaved evergreens when flower colors are harmonized.

Culture: Well-drained acid soil, rich in organic matter; partial shade.

Varieties: Among numerous hybrids the "Iron-Clads" offer more acceptable colors, among them: 'Boule de Neige' and 'Album Elegans' (white), 'Charles Dickens' and 'America' (red), 'Everestianum' and 'Roseum Elegans' (pink) and 'Purpureum Elegans' (purple).

Pinkshell Azalea
Rhododendron vaseyi

Outstanding Features: Pale pink to almost white flowers in May before the leaves are fully out. Autumn foliage red.

Gottscho-Schleisner
MOCK-ORANGE (*Philadelphus coronarius*)

Habit and Use: A tall shrub, sometimes 10 feet or more; extremely hardy. If a plant of this height can be placed

Gottscho-Schleisner
CATAWBA RHODODENDRON
(*R. catawbiense*)

within view from a window, its early bloom can be enjoyed in any weather.

Other Recommended Azaleas: Pinxterbloom, or pinkster-flower (*R. nudiflorum*), with fragrant pale-pink flowers starting to open before the leaves on plants 2 to 5 feet tall. Rose-shell azalea (*R. roseum*), similar to pinxterbloom, with fragrant flowers of deeper pink appearing with the early blue-green leaves. These plants are slightly taller.

Ghent hybrids have great diversity of color: 'Coccinea Speciosa' (brilliant orange-red), 'Davesi' (white with yellow eye), 'Narcissiflora' (pale yellow and double), 'Pallas' (pink with orange blotch). Other fine hybrids in increasing numbers are becoming available.

Gottscho-Schleisner

MOUNTAIN-LAUREL (*Kalmia latifolia*)

Roche

PINXTERBLOOM
(*Rhododendron nudiflorum*)

Mountain-laurel

Kalmia latifolia

Outstanding Features: An evergreen shrub with large rounded clusters of waxy flowers, pink in bud and white or pink when open, generally before mid-June.

Habit and Use: Upright and spreading, usually under 10 feet in height in cultivation (though blooming when 3 to 5 feet tall). Glossy-green foliage which remains flat in winter, not rolling inward as do the leaves of most rhododendrons. Fine specimen shrub; also good at edge of wooded areas.

Culture: Acid soil imperative. In sun the plants are compact and floriferous. In shade they grow taller and bear fewer flowers.

CAMELLIA
(*Camellia japonica*)

SOUTHEAST

Choices for the Southeast

Fred C. Galle

Camellia ***Camellia japonica***

Outstanding Features: Handsome evergreen foliage and large abundant flowers of white, pink, red or in combination from fall until early spring on different varieties.

Habit and Use: Medium to tall shrubs, well furnished with glossy leaves. Flowers single or double, waxy in texture. Indispensable as a specimen or border shrub.

Culture: Slightly acid, well-drained soil; light shade.

Varieties: For Upper South, early flowering kinds: 'Arejishi' (salmon rose), 'September Morn' (white), and 'Daikagura' (rose-red); and late-blooming kinds such as 'Berenice Boddy' (pink). For Lower South, where camellias bloom throughout the winter season, there are hundreds of varieties to choose from.

Other Species: *Camellia sasanqua* is a fall-flowering species with flowers of more papery texture, from white to deep rose, the tones sometimes in combination. Outstanding double varieties are 'Jean May' (pink), 'Bettie Patricia,' and 'Sparkling Burgundy'; single and semidoubles: 'Gulf Glory' (white), 'Charles Pearson' and 'Setsugekka' (white).

McFarland

SASANQUA CAMELLIA (*C. sasanqua*)

Gardenia ***Gardenia jasminoides***

Outstanding Features: Heavily-scented, waxy-white flowers about 3 inches across blooming in succession throughout the summer.

Habit and Use: About 5 feet tall with highly polished evergreen foliage. Attractive all the year, wherever planted.

Culture: Well-drained, fertile acid soil. Partial shade.

Varieties: 'Fortunei,' 'Mystery' and *G. jasminoides fortuniana,* sometimes called 'Veitchi,' mostly larger-flowered sorts. *G. jasminoides radicans* is a low-growing plant with smaller flowers.

Flowering Quince ***Chaenomeles lagenaria***

Outstanding Features: Early flower color on leafless shrubs, a welcome sign of approaching spring (February in South).

Habit and Use: To 6 feet tall, deciduous, of varying shapes. Useful in shrub border; also attractive alone.

Culture: Not demanding as to growing conditions.

Varieties: Among the good color selections are 'Nivalis' and 'Snow' (white); 'Blood Red,' 'Ruby Glow,' 'Red Ruffles,' and 'Red Chief' (deep red); 'Clark 319' (salmon-orange); 'Margaret Adams,' 'Phyllis Moore,' 'Pink Beauty,' 'Coral Beauty' (pink); 'Shinome,' 'Apple Blossom,' and 'Toyonishi' (bicolored).

Tea-olive *Osmanthus fragrans*

Outstanding Features: Small white flowers that perfume the surrounding air in late summer and early fall.

Habit and Use: Sometimes tree-size, therefore best used in backgrounds or against large buildings. Leaves evergreen, slender, about 3 inches long and finely toothed.

Culture: No special requirements, except for ample humus in the soil.

Other Species: Holly osmanthus (*O. ilicifolius*) and Fortune's osmanthus (*O. fortunei*), a hybrid, both with spine-toothed leaves.

Note: *Osmanthus fragrans* is also called sweet-olive.

Crape-myrtle *Lagerstroemia indica*

Outstanding Features: Abundant, colorful, crinkly flowers in summer.

Habit and Use: Deciduous. May grow to tree-size in sun but can be kept to 6 to 8 feet by pruning. A good background or specimen shrub.

Culture: Any good soil plus ample moisture and fertilization.

Varieties: 'William Tovey' (also called 'Watermelon Red') and 'Near East,' a striking shell-pink. There are also attractive white, pink and lavender varieties.

Mountain-laurel *Kalmia latifolia*

In the Southeast it is mostly used in naturalistic or woodland plantings, rather than in the home landscape, though suitable there in many situations. See page 38.

Gottscho-Schleisner

CRAPE-MYRTLE (*Lagerstroemia indica*)

Flowering Jasmine *Jasminum floridum*

Outstanding Features: Clusters of fragrant yellow flowers about an inch across appearing spasmodically from late spring through summer.

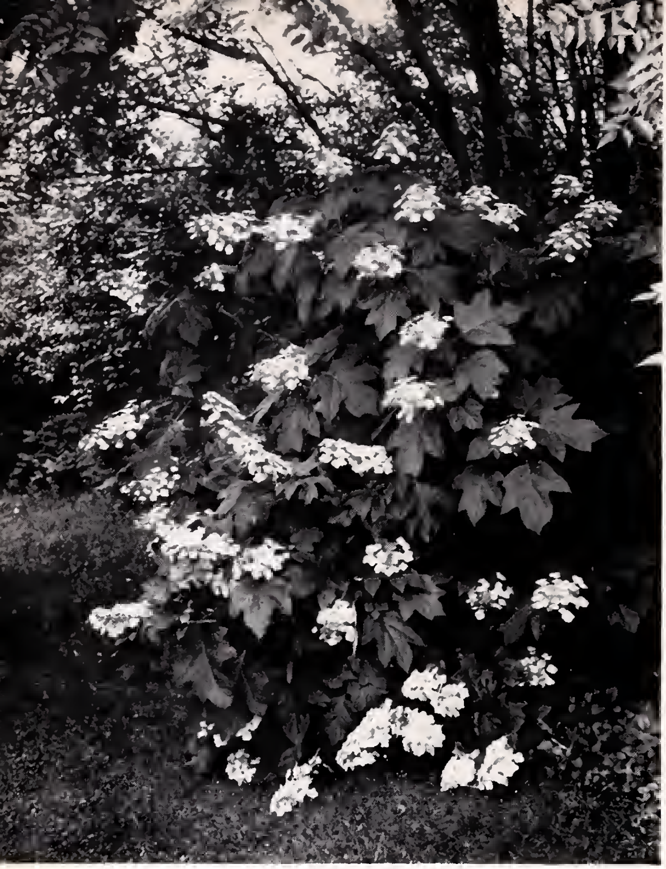
Habit and Use: Half-evergreen, with drooping branches that make it excellent for the top of a retaining wall; erect growth about 3 feet high. Also used against foundations.

Culture: Sun and loamy soil.

Glossy Abelia *Abelia grandiflora*

Outstanding Features: A generous sprinkling of pale pink flowers all summer and through the fall.

Habit and Use: Evergreen (in South); of vigorous growth that has to be restricted (and which has made this shrub lose favor in the South). A good choice where fine texture is desired among other shrubs.



McFarland

OAKLEAF HYDRANGEA
(*H. quercifolia*)

Culture: Leaf-mold in the soil desirable.

Varieties: 'Sherwood,' not exceeding 3 feet; *A. grandiflora prostrata,* a mound 2 feet in height; 'Edward Goucher' to 5 or 6 feet with flowers of deep rose.

Oakleaf Hydrangea
Hydrangea quercifolia

Outstanding Features: Large flower-clusters in late spring; wine-colored autumn foliage.

Habit and Use: About 5 feet tall, of rather coarse appearance in all seasons, especially after leaves have dropped; therefore best used against evergreen background. Flowers white, gradually turning pink; long lasting and useful in dried arrangements.

Culture: Preferably in sun or light shade, in any good garden soil.

Kurume Azalea
Rhododendron hybrid

Outstanding Features: Evergreen plants with wide range of flower colors from white to pink to red and purple.

Habit and Use: Widely used in foundation and mass plantings—for sun or partial shade.

Culture: Acid soil, ample humus and moisture.

Other Species: Indica azaleas (*R. indicum*), less hardy, best in Mid- to Lower South; Glenn Dale azaleas, excellent, numerous varieties, useful to extend flowering by using mid- to late-season varieties; Macranthas; and Satsuki or Chugai hybrid azaleas —late flowering. Use these in partial shade.

Choices for the Midwest

John E. Voight

Persian Lilac ***Syringa persica***

Outstanding Features: Extremely hardy and delightfully fragrant, with small clusters of pale-lilac flowers toward the end of May.

Habit and Use: Rounded in outline, about 5 feet tall, with willowy branches covered to the ground with small dark shiny leaves. Useful as specimen, in a shrub border, or as a hedge or screen.

Culture: Will grow in dry soil; easy to transplant.

Siberian Dogwood ***Cornus alba sibirica***

Outstanding Features: Clusters of small white flowers in late May, white to slightly blue fruits in the fall, and bright red winter twigs.

Habit and Use: Broad and spreading, averaging 6 to 7 feet in height. Appears to best advantage in a mixed border.

Culture: Moist situation with heavy soil can be tolerated.

Taloumis

ARROW-WOOD (*Viburnum dentatum*)

Genereux

PERSIAN LILAC (*Syringa persica*)

Arrow-wood ***Viburnum dentatum***

Outstanding Features: Brilliant red leaves and clusters of bluish-black fruits in October. Flowers in early summer, in flat creamy-white clusters; summer foliage bright green.

Habit and Use: Vigorous, upright, to 12 to 15 feet with many basal shoots. Densely clothed with foliage. Good for hedges or screens, in background of border, as specimen, or in naturalistic planting.

Culture: Any good garden soil in sun or partial shade.

Alpine Japanese Quince ***Chaenomeles japonica alpina***

Outstanding Features: Brilliant orange flowers more than an inch across in early May on a dwarf deciduous shrub.

Habit and Use: Broad and many-branched, of dense twiggy character, seldom exceeding a foot in height.

Foliage of a good green. Especially useful as a facer for taller shrubs, in borders, foundation plantings, and as a thicket-like ground cover.

Culture: Best in full sun in any garden soil, but will tolerate some shade.

Early Forsythia
Forsythia ovata

Outstanding Features: Pale yellow flowers covering branches before the leaves; compact, restricted growth.

Habit and Use: Flowers smaller and less abundant than on *F. intermedia,* the most commonly planted species, but they open a week to ten days earlier. Height can be kept at 5 or 6 feet and the shrub further pruned if desired.

Culture: Any garden soil in sun or part shade; this is the hardiest of all forsythias.

Wayfaring-tree
Viburnum lantana

Outstanding Features: Fruit-clusters attractive from late summer to fall as they gradually turn from green to red to black, while the leaves in autumn change from dull bluish green to reddish purple.

Habit and Use: Upright, vigorous, open, often 10 to 15 feet tall. Flat clusters of white flowers in mid-May; leaves rather coarse, wrinkled and toothed. Useful as a background shrub or at woodland margins.

Culture: Any good garden soil; dry areas tolerated; very little maintenance required.

Cornelian-cherry *Cornus mas*

Outstanding Features: One of the earliest shrubs to bloom, bearing an abundance of small bright-yellow flowers in dense globular clusters close to the branches before the leaves appear.

Habit and Use: A sturdy plant about 15 feet in height. Lustrous foliage, persisting to late fall. Small edible scarlet fruits in August partly hidden by leaves. Being a versatile plant, of continued interest through the seasons, this deserves wider use in shrub border, as a specimen, or at woodland margins.

Culture No special demands; tolerant of the polluted air of cities.

Cotoneaster
Cotoneaster multiflora

Outstanding Features: Ornamental in all aspects, with clusters of small white flowers along the stems in early spring, attractive blue-green foliage in summer, pinkish-red berries in fall, and a branching pattern that gives an interesting winter effect against the snow.

Habit and Use: Wide-spreading and gracefully arching so that flowers or fruits are always in view. About 6 feet in height, sometimes taller, and the same in breadth. Deciduous. Where space permits, a desirable accent plant or specimen.

Culture: Any average soil if well drained.

Shrubby Cinquefoil
Potentilla fruticosa

See page 45.

Prairie Rose *Rosa setigera*

Outstanding Features: Clusters of five-petaled pink flowers in July after most other roses are gone.

Habit and Use: A sprawling shrub, seldom over 4 feet high, with arching canes to 10 feet in length. Leaves three-parted, of a good green in summer, bronzy-red in autumn. Exceedingly hardy. Excellent for naturalistic planting and for game-cover purposes.

Culture: Any well-drained soil.

Choices for the Rocky Mountain Region

George W. Kelly

Beauty-bush
Kolkwitzia amabilis

Outstanding Features: Profusely blooming in mid-spring. Pink, yellow-throated, flaring bells in clustered pairs make up the show of flowers. Neat soft-textured leaves of gray-green make it a perfect background shrub. Decorative dry fruits in summer.

Habit and Use: About 8 feet high with arching upper branches, though it can be trained higher in close quarters or against a wall.

Culture: Porous soil and, where practical, an open, airy situation.

Shrubby or Bush Cinquefoil
Potentilla fruticosa

Outstanding Features: Adaptable to dry or wet, shady or sunny situations, as might be expected of a plant that grows from arctic heights to lowland swamps throughout the Northern Hemisphere. Small yellow flowers in the wild rose pattern. Small pinnate leaves, often grayish with silky hairs.

Taloumis

BEAUTY-BUSH (*Kolkwitzia amabilis*)

Gottscho-Schleisner

BUSH CINQUEFOIL (*Potentilla fruticosa*)

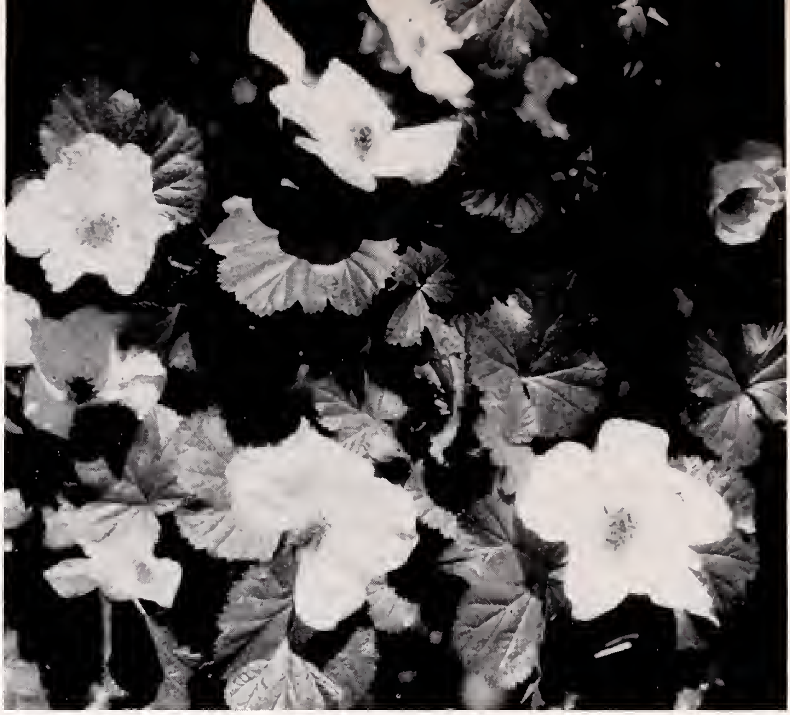
Habit and Use: Dwarf and summer-flowering; spreading into clumps. A shrub of many uses.

Culture: While it will grow in almost any situation, it does especially well in dry, well-drained soil.

Varieties: Numerous horticultural selections for good flowering, in colors from white to deep yellow, have been made. 'Gold Drop' is a vigorous plant for the Rocky Mountain area.

Dwarf Pea-shrub
Caragana aurantiaca

Outstanding Features: Compact plant with four-parted green leaves and



Kelly

BOULDER RASPBERRY (*Rubus deliciosus*)

numerous orange-yellow pendent blooms in the pea-flower fashion of wings and keel, late spring.

Habit and Use: Stays under 3 feet in height. A hardy Central Asian plant which is drought resistant.

Culture: Ordinary garden soil, preferably in full sun.

Jetbead ***Rhodotypos scandens***

Outstanding Features: Neat white flowers of four thin petals and numerous yellow stamens in late spring, followed by shiny black pea-sized fruits which persist in winter.

Habit and Use: Shrub of 6 feet or less of a loose, airy structure. Recommended for use in shady places, where other trees and shrubs can give it protection.

Culture: Ordinary garden soil in a sheltered spot.

Boulder Raspberry
Rubus deliciosus

Outstanding Features: Gracefully arching thornless branches of attractive foliage, the leaves in a pattern of three or five shallow lobes. Two-inch white flowers resemble single wild roses.

Habit and Use: Of medium height (up to 6 feet); summer flowering. Its tangle of branches a good background for low plants in a border.

Culture: Easy to grow as long as there is good drainage. Of unquestioned hardiness.

Korean Spirea
Spiraea trichocarpa

Outstanding Features: A bridal-wreath that flowers a week later than the common Van Houtte spirea. White flowers in the same pattern of small umbels, many along the upper part of each stem.

Habit and Use: Has an irregular spreading habit and is a hardy plant for elevations above 6,000 feet.

Culture: No special requirements, but full sun and reasonable moisture bring their reward.

Cliff Jamesia

Jamesia americana

Outstanding Features: The delicate waxy-white flowers borne in a flat cluster are slightly fragrant. A slow-growing shrub. Hairy gray-green leaves, roughened with many veins, coloring orange and scarlet in the autumn.

Habit and Use: Mostly stays below 6 feet, especially at the higher elevations, where it can be used safely. Good in rock crevices.

Culture: Sun, air and well-drained soil.

Bush Rock-spirea

Holodiscus dumosus

Outstanding Features: A fairly tall shrub of dense, regular growth, bearing in summer plump white flowers, individually small but numerous on a branched stalk.

Habit and Use: Recommended for its ability to grow in a hot, dry situation. Possible height is 8 feet.

Culture: Sandy loam; full sun.

Kelly

BUSH ROCK-SPIREA (*Holodiscus dumosus*)

Kelly

CLIFF JAMESIA (*J. americana*)

Golden Currant ***Ribes aureum***

Outstanding Features: Spicy fragrance from the bright-yellow flowers fills the air in May. Blackish edible fruits follow.

Habit and Use: Non-spiny, rather dense twig structure, a 6-foot shrub, useful for attracting birds and filling shaded corners.

Culture: No special needs beyond good garden soil.

Variety: There is a golden-fruited natural form, variety *chrysococcum.*

Nanking Cherry

Prunus tomentosa

Outstanding Features: Abundant flowers, white or pink-tinted, very early; small leaves with finely toothed margins on rather twiggy branchlets. Edible red fruits ripen in early summer. Exceedingly hardy.

Habit and Use: Usually grows broader than tall, a rounded mass covered with foliage to the ground. Requires more than one plant for good fruiting. Excellent bird protective cover and food.

Culture: Normal attention in any good garden soil.

Varieties: Several selections of this Chinese shrub have been made in this country for fruiting qualities.

Choices for the Southwest

W. H. Earle

Silver Cassia

Cassia artemisioides

Outstanding Features: Yellow flowers in tight clusters, January to April; later, many shiny black seeds.

Habit and Use: A shrub 3 to 6 feet in height, the branches covered with a silky down. Flowers clustered near the tips of branches. Leaflets narrow, short and stiff. Appearance distinctive at all seasons, making this plant suitable as a specimen.

Culture: Light sandy loam in sun with ample space around the plant.

Scented Acacia

Acacia farnesiana

Outstanding Features: A pronounced and pleasant perfume in its tiny balls of yellow flowers, February to April.

Habit and Use: A tall spiny shrub (6 to 8 feet), occasionally becoming treelike; the branches zigzag, leaflets minute. Sometimes cultivated as a source of perfume.

Culture: Full sun and a sandy loam.

Desert Botanical Garden

SILVER CASSIA (*C. artemisioides*)

Bottlebrush

Melaleuca hypericifolia

Outstanding Features: Attractive weeping habit in a tall shrub that bears red-stamened flowers closely set in spikes that look like bottle brushes.

Habit and Use: Height 6 to 12 feet; small stiff leaves closely spaced along the branches. Flowering continuous from April to October. An effective plant when standing by itself.

Culture: Peat moss in the soil is beneficial.

Desert Botanical Garden

Seed-pods of
SCENTED ACACIA (*A. farnesiana*)

Lantana

Lantana camara nivea

Outstanding Features: A good dense shrub with verbena-like clusters of flowers opening white, the outer ones then changing to nearly blue.

Habit and Use: Abundant bloom from May to October; the plant rough and prickly, 2 to 3 feet tall. A good flowering hedge.

Culture: Full or nearly full sun in a rather rich soil.

Varieties: Numerous kinds, all with changing tones, embrace a wide range of flower colors: yellow, orange and red in some; pink, lilac and blue in others, with various combinations, often starting with white.

Note: *L. camara nivea* is sometimes known as *L. nivea mutabilis.*

Texas Silver-sage
Leucophyllum texanum

Outstanding Features: Tubular pink flowers, opening in six-week cycles, give continuous bloom, June-October.

Habit and Use: Height 3 to 4 feet, the twigs gray, the leaves not more than 1 inch long, their lower surfaces covered with a silvery wool. The flowers 1 inch long with five rounded, spreading lobes. The plant useful as an accent in a flower border or in a group of less floriferous shrubs.

Culture: Sun, sandy loam, and only a small amount of water.

Trumpet-bush
Tecoma stans angustata

Outstanding Features: Golden-yellow trumpet-shaped flowers 1½ inches long in large clusters, July-October.

Habit and Use: Deciduous, 3 to 4 feet high (sometimes taller) and wide-spreading, with large compound leaves, the leaflets sharply toothed. A showy plant, whose bright abundant flowers and leafless winter branches suggest that it be planted at a distance. Variety *angustata* is hardier than the species.

Desert Botanical Garden

TRUMPET-BUSH (*Tecoma stans angustata*)

Desert Botanical Garden

TEXAS SILVER-SAGE (*Leucophyllum texanum*)

Culture: Ordinary care, in sandy soil with occasional fertilizer to nourish its robust growth.

Note: Also known as yellow-elder or yellow bells and as *Stenolobium stans.*

Viburnum ***Viburnum suspensum***

Outstanding Features: Endures intense heat. White to pink flowers in small clusters, July to October.

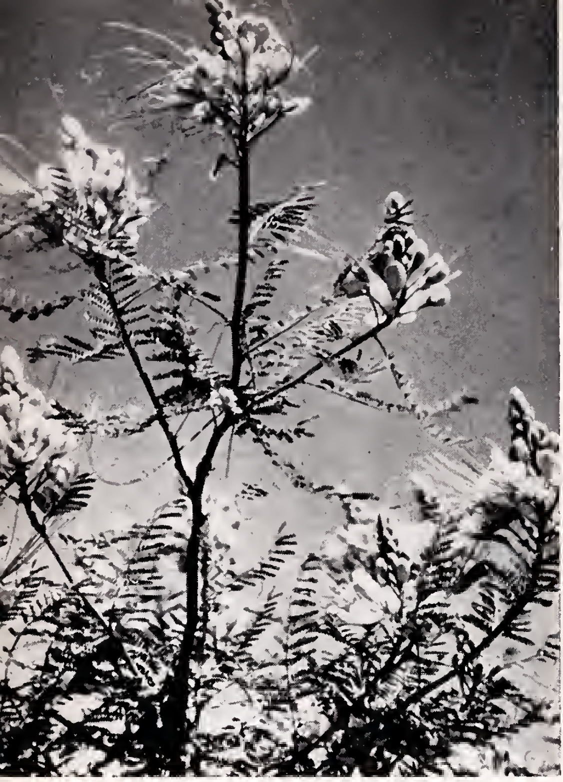
Habit and Use: A shrub 4 to 6 feet tall with slightly toothed evergreen leaves; the small flowers followed by fruits which are red, then black. Appearance modest but pleasing at all seasons.

Culture: Average garden soil; no special care required.

Jacobinia
Jacobinia ghiesbreghtiana

Outstanding Features: Bright-orange flowers on a low-growing plant, October to February.

Habit and Use: The flowers loosely clustered, somewhat tubular; the plant, 1 to 2 feet high, making a good ground-cover shrub.



Desert Botanical Garden

BIRD-OF-PARADISE-BUSH
(*Caesalpinia gilliesi*)

Culture: A sandy loamy soil containing some leaf-mold. Light shade desirable in summer, full sun rest of year.

Bird-of-Paradise Bush ***Caesalpinia gilliesi***

Outstanding Features: From May to October, large erect terminal clusters of yellow flowers, each nearly 3 inches across, with long red stamens.

Habit and Use: Height 3 to 6 feet; large leaves, finely divided into many leaflets. The plant excellent against a wall or as a long-blooming background for smaller, less conspicuous shrubs.

Culture: Full sun; leaf-mold in the soil.

Firethorn ***Pyracantha coccinea***

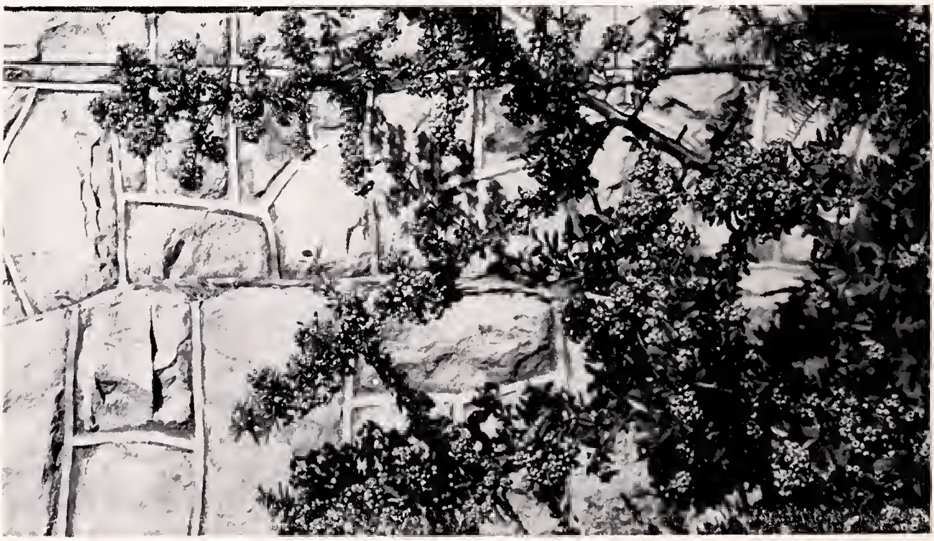
Outstanding Features: Bright red berries over a long period against dark evergreen foliage.

Habit and Use: An upright shrub or climber 3 to 8 feet high; small white flowers covering the plant in April and May; round scarlet fruits throughout the winter; the leaves narrow, somewhat oval, 1 or more inches long. Outstanding in winter aspect, and especially good against a wall.

Culture: Ordinary garden soil; sun or light shade.

Crape-myrtle ***Lagerstroemia indica***

See page 41.



McFarland

FIRETHORN (*Pyracantha coccinea*)

Grossman

RHODODENDRON 'BOW BELLS' (*Rhododendron* hybrid)

Choices for the Pacific Coast, North

Joseph A. Witt

Rhododendron 'Bow Bells'
***Rhododendron* hybrid**

Outstanding Features: A consistently beautiful plant with neat evergreen foliage and pink bell-shaped flowers about 2 inches across in loose trusses of five or six in early May.

Habit and Use: Seldom more than 6 feet in height but somtimes spreading a bit more. Small heart-shaped leaves, the new growth brilliant bronze in April and May. An all-purpose plant for every garden.

Culture: Acid soil with ample humus; light shade.

Pontic Azalea
Rhododendron luteum

Outstanding Features: Fragrant yellow flowers in late April or early May; brilliant orange to red autumn foliage in October and November.

Habit and Use: Large round-headed shrub to 8 or 9 feet tall and somewhat wider, its mound of foliage covered with golden yellow in the flowering season.

Culture: Acid soil with humus, ample moisture; either full sun or sheltered shade.

Shrubby Penstemon
Penstemon fruticosus

Outstanding Features: A wealth of flowers from soft pink to lavender standing well above the evergreen foliage.

Habit and Use: Range of height 6 to 18 inches; foliage similarly variable. Snapdragon-like flowers are 1 to 2 inches long on 2- to 4-inch spikes. Suited to sunny rock gardens; especially effective in mass plantings.

Culture: Good garden soil, thorough drainage; abundant moisture in winter, little in summer.

Varieties: *P. fruticosus serratus* with small serrated leaves; *P. fruticosus scouleri,* with long-toothed leaves. Several clones have been selected from the species for both flower color and foliage.

William Eng
Courtesy of Univ. of Washington Arboretum
CALIFORNIA-LILAC (*Ceanothus impressus*)

California-lilac
***Ceanothus impressus* 'Puget Blue'**

Outstanding Features: A blanket of gentian-blue flowers hiding the small leaves from late April to mid-May.

Habit and Use: An erect evergreen shrub, to 10 feet tall, selected and named by the University of Washington Arboretum.

Culture: Light well-drained soil, preferably in sun.

Other Kinds: Although *Ceanothus* species and hybrids are primarily Californian in origin, a number are excellent as ornamental shrubs in the more northern Pacific States. Outstanding, besides 'Puget Blue,' is 'Gloire de Versailles,' a large-leaved deciduous shrub with puffs of powder-blue flowers that open periodically from July until the first hard frost in December.

Eucryphia ***Eucryphia glutinosa***

Outstanding Features: White flowers 2 inches across, often in pairs, at ends of branches in August, their centers sometimes tinted blue by the stalks of the numerous stamens.

Habit and Use: Ultimately 20 feet in height but very slow growing. Small, toothed, pinnate leaves, dark glossy green, sometimes partly evergreen. Flowers honey-scented in some plants. Suitable for any except the smallest gardens.

Culture: Loamy acid soil.

Chinese Witch-hazel
Hamamelis mollis

Outstanding Features: Orange-yellow flowers like gems against bare branches from late December into January. Leaves turning gold in autumn.

Habit and Use: Ultimate height and spread, well over 15 feet, precluding its use in small gardens. Leaves large; winter habit picturesque.

Culture: Full sun or filtred shade.

Columbia Manzanita
Arctostaphylos columbiana

Outstanding Features: Hardiest of all the manzanitas, most of which are Californian in origin. Tight clusters of small pinkish urn-shaped flowers at ends of shoots in late February or March.

Habit and Use: A ruggedly branched shrub of handsome design, with burnished mahogany stems and dark evergreen leaves covered with fine down. Rich brown fruits in late summer. Height, 10 feet or more. Desirable as a specimen shrub.

Culture: Well-drained acid soil essential; shrub difficult to transplant.

Grossman
COLUMBIA MANZANITA
(*Arctostaphylos columbiana*)

Camellia 'Donation'

Camellia williamsi* *(C. saluenensis × C. japonica)

Outstanding Features: Great numbers of semidouble flowers, 4 to 5 inches across, shell-pink to rose in color, falling when spent.

Habit and Use: Tall and erect with ultimate height of over 10 feet but growing at a moderate rate. Evergreen leaves more slender than those of *Camellia japonica* and carried less densely on the branches.

Culture: Well-drained acid soil, partial shade.

Oregon-grape

Mahonia aquifolium

Outstanding Features: Holly-like leaves, bronzy to red in winter; tight clusters of bright yellow flowers in late March; purple grapelike fruits.

Habit and Use: Seldom more than 6 feet tall in sun, about 15 feet in a sheltered site or woodland garden. Especially valuable for color in its native region (the Northwest) where skies are gray much of the winter.

Culture: Any garden soil in sun or shade. In colder climates it must have protection from both wind and sun in winter.

Other Species: *Mahonia nervosa,* rare in cultivation, but even more beautiful in flower, with long yellow spikelike racemes.

Atlas Broom ***Cytisus battandieri***

Outstanding Features: Fragrant bright-yellow flowers at ends of new shoots from late June through late July.

Habit and Use: Ultimate size 6 or 7 feet in height and spread; leaves large, silvery gray, three-parted, semideciduous. Flowers pea-shaped.

Culture: Well-drained friable soil in sun; tolerates dry conditions.

Whitie Marten
Courtesy U. of W. Arboretum

CAMELLIA 'DONATION' (*C. williamsi* hybrid)

OREGON-GRAPE (*Mahonia aquifolium*)
Genereux

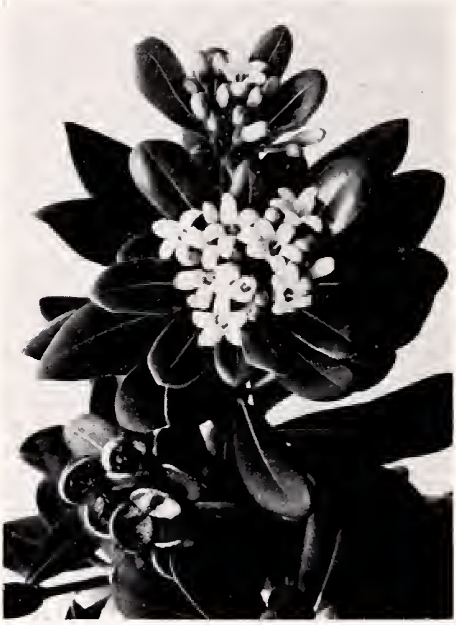
Courtesy U. of W. Arboretum

Whitie Marten

OREGON-GRAPE; WATER-HOLLY (*Mahonia nervosa*)

Choices for the Pacific Coast, South

Leonid Enari



Kassler
Courtesy Los Angeles State and County Arboretum
JAPANESE PITTOSPORUM
(*P. tobira*)

Japanese Pittosporum *Pittosporum tobira*

Outstanding Features: Clusters of white flowers in summer, fading to light yellow, pleasingly scented. Leaves are dark green and leathery with the margins turned under. A handsome broad-leaf evergreen.

Habit and Use: Densely growing up to 10 or 15 feet; often used as an evergreen hedge.

Culture: Easily grown in good garden soil.

Variety: 'Variegatum,' with white-variegated leaves.

Oleander *Nerium oleander*

Outstanding Features: A Mediterranean plant so commonly used that it is thought to "look like a California native." Its profuse flowering in showy clusters through summer and fall on the new growth of the season has ensured its popularity. The long narrow leaves are leathery; there are variegated forms.

Habit and Use: Evergreen shrub of 15 feet or more, long used as a plant

JAPANESE PITTOSPORUM
(*P. tobira*)

Mai K. Arbegast

for large tubs in indoor displays. Unfortunately, all parts of the plant are poisonous if eaten. One leaf alone contains a fatal amount of toxic material. But it seems so firmly entrenched in ornamental plantings in California and elsewhere that we, and especially our children, must learn how to live with it. Seen in borders of oleander alone or with other shrubs, against walls, and as single specimens.

Culture: Full sun; moist well-drained soil amply supplied with organic matter. The plants require little attention and are tolerant of city conditions.

Varieties: Oleander runs into many forms with white, pink, red or light yellow single, semidouble or double flowers.

Courtesy LASCA

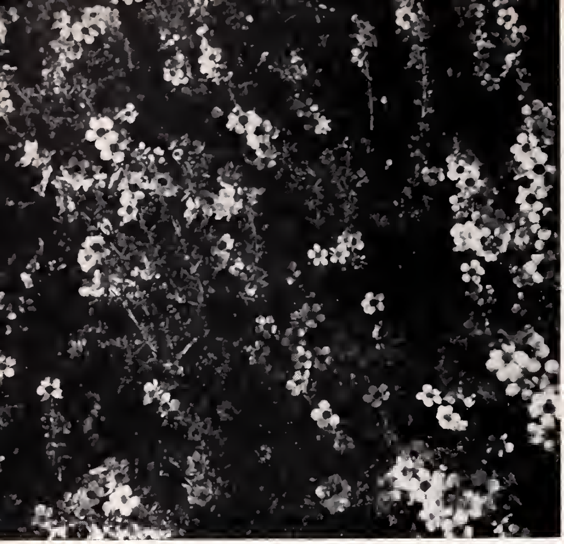
OLEANDER (*Nerium oleander*)

Natal Plum ***Carissa grandiflora***

Outstanding Features: Grown for the fragrance of its solitary flowers well set off by rounded thick leathery leaves. The five petals are white, the lobes spreading 2 to 3 inches wide and united into a tubular base a half-inch long. The branches bear spines which are often forked into miniature antlers.

NATAL PLUM
(*Carissa grandiflora*)

Mai K. Arbegast



Mai K. Arbegast

MANUKA TEA-TREE (*Leptospermum scoparium*)

Habit and Use: Evergreen shrub reaching 6 feet, sometimes higher, of value as a hedge plant. Its edible fruit, 1 or 2 inches long, containing papery seeds, is not a true plum, and is better suited to making preserves than for eating raw.

Variety: 'Prostrata' is a low mat-making plant useful as a ground cover.

Lemon Bottlebrush

Callistemon citrinus

Outstanding Features: Brilliant crimson flowers consisting of fluffy stamens. The flowering stems continue to grow as leafy shoots, and persistent tightly-clustered dry fruits remain on these stems for a dozen years or more.

Habit and Use: Evergreen shrub which may reach 15 feet. Its narrow leaves are somewhat rigid. Dense twig growth permits its effective use as a hedge. Its area of use includes the San Francisco region and Florida. One of the hardiest of the Australian bottle-brushes.

Variety: 'Splendens' is a selection for brightness in the coloring of the stamens, the ornamental part of the flowers.

Note: *Callistemon citrinus* is also known as *C. lanceolatus*.

Manuka Tea-tree

Leptospermum scoparium

Outstanding Features: The horticultural forms of this native of New Zealand and Australia provide some of the most beautiful of cultivated shrubs in California. The species, which has white flowers less than an inch across and small narrow leaves, tends to become treelike.

Habit and Use: Foliage is evergreen. The ornamental varieties vary from dwarf forms of 2 feet to 10-foot specimen shrubs.

Culture: Sandy soil, which it helps to hold in place, suits it well.

Varieties: The several forms range through white, pink or red and single, semidouble or double flowers. Some are combined with leaf variations such as 'Nichollsi,' carmine flowers and bronzy leaves; 'Ruby Glow,' brilliant-red flowers and dark foliage; 'Keatleyi,' 1-inch pink flowers and olive-green foliage.

Chinese Hibiscus

Hibiscus rosa-sinensis

Outstanding Features: Free-flowering throughout the summer, the typical plant with bright rose-red, vase-form, solitary flowers 6 inches across, with a protruding tongue of golden-yellow stamens. Leaves are dark green, ovate, coarsely toothed and have conspicuous stipules at the base of the stalk.

Habit and Use: Usually kept under 10 feet as an ornamental shrub for flower effect; in tropical areas it becomes a small tree. Though presumed to have come from China, where it is commonly grown in temple gardens, its wild form has not yet been discovered. The Chinese have made use of a substance from the flower petals for shoe blacking and hair dye.

Culture: Extra humus and fertilizer both needed in the soil.

Varieties: A large number of flower colors, both double and single, are commercially grown, along with a few variegated and other leaf variants.

Mexican Orange *Choisya ternata*

Outstanding Features: By appearing in clusters at ends of branches, the faintly scented white flowers are conspicuous over the mass of three-parted leaves. Individual blossoms up to an inch across. Leaf and stalk are about 6 inches long, the three leaflets variable in size. They are smooth, have translucent dots, and a strong aromatic odor when crushed.

Habit and Use: A rounded plant from 6 to 10 feet high with evergreen foliage. Though from Mexico, it will stand a few degrees of frost. Appearance and fragrance make it outstanding in a shrub border.

Culture: The same as for surrounding plants, no special demands being made.

Sweet-olive *Osmanthus fragrans*

Outstanding Features: Extremely fragrant white flowers, though small and inconspicuous. Leaves are to 4 inches long, pointed at the tip, leathery and unusually sharply toothed.

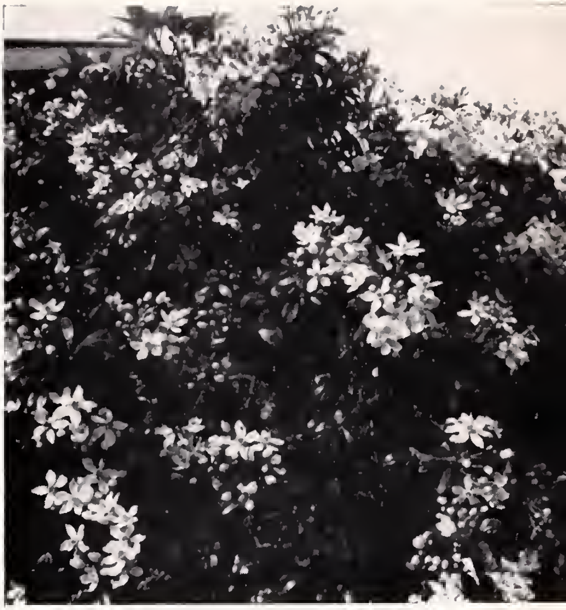
Habit and Use: Though it may reach tree heights, it is usually grown as a shrub of 10 feet or so. With its handsome evergreen leaves, which are reddish when young, it is useful trained to a wall. In its native China the dried flowers are used to impart their fragrance to the finest quality of jasmine tea.

Culture: Ordinary garden soil; no special care required. An old-time conservatory plant that thrives particularly well in the open in California.

Variety: 'Aurantiacus,' with orange-colored flowers and large leaves without teeth.

Wormwood Senna *Cassia artemisioides*

Its low moisture requirements make it particularly suited to desert conditions. Also known in the Southwest as silver cassia. See page 48.



Mai K. Arbegast

MEXICAN ORANGE (*Choisya ternata*)

Night-Blooming Jessamine *Cestrum nocturnum*

Outstanding Features: Though fragrant at a distance of 20 feet at night, the numerous small greenish flowers are completely scentless in the daytime. The fruits are fleshy white berries. Flowering is intermittent throughout the year. The leaves have even margins and are commonly twice as long as wide.

Habit and Use: A tall shrub, about 10 feet in height, with slender branches. As its leaves do not have the disagreeable odor of some other cestrums, it may be used close to living areas. Excellent for training up a wall or pillar.

Culture: A light loamy soil is best.

Note: Commonly offered in Southern California as *Cestrum parqui,* a name which belongs to a plant from Chile with black berries. *C. nocturnum* is the correct name for the West Indian white-berried plant, long cultivated in Mexico, where it is known as "dama de noche," lady of night.

INTERESTING 'FINDS' IN EUROPEAN GARDENS

Personal reminiscences of

Jacques Legendre

SINCE coming to the United States from France in 1912, I have had many rich experiences. The first was the privilege of working for the H. A. Dreer Company of Philadelphia, under the leadership of the President, Mr. J. D. Eisele. I soon realized the importance of looking in Europe for plants which were not then grown in the United States, but which would quickly adapt to American conditions and climate. Since that time I have become well acquainted with most of the European nurseries and botanic gardens. One of my first finds was the red Japanese barberry (*Berberis thunbergi atropurpurea*) which had appeared as a chance seedling in a French nursery, but had never been distributed. I was still with H. A. Dreer and this well-known firm soon propagated and distributed it throughout the States.

After Quarantine 37 was enacted, it became more than ever necessary to look for plants that would be new to American gardens. For the past 20 years, since establishing my nursery in Virginia, I have visited Europe at least once a year, except for the war years, and have had the pleasure—through my connections—of introducing many new plants. Some of my best finds have been the 'Crimson King' maple (*Acer platanoides schwedleri nigra*), Althea 'Blue Bird,' A. 'Woodbride,' *Callicarpa japonica leucocarpa,* Forsythia 'Lynwood Gold,' Hypericum 'Hidcote,' Philadelphus 'Silver Showers,' *Spiraea nipponica* 'Snowmound,' *S. japonica alpina* Vinca 'Miss Jekyll's White,' *Stephanandra incisa crispa, Salix sachalinense* 'Sekka,' Tamarix 'Pink Cascade.' All the above were brought in from England, France, Germany. During all these trips, I have made some wonderful friends, especially in England at Kew Gardens, the Royal Horticultural Society's Garden at Wisley, Windsor Great Park, Edinburgh Botanic Garden, and at many commercial nurseries. In all these places I have found new friends who have helped me in the search for plants that would be new to America. I have not mentioned roses in these lists, for while I have always been interested in new roses, for the past years shrubs and trees have taken most of my time. Just the same, I take pride in having introduced into this country the moschata hybrid, originated in England many years ago under the name of 'Robin Hood.' It has proved to be one of the most disease-resistant roses, everblooming and very well adapted for hedges. While the list of plants mentioned above is quite extensive, I have brought in many others over the years which were discarded after thorough testing.

I am looking forward to further trips abroad with the purpose of looking for new plants, but the experience of the past few years indicates that good new plants are more and more difficult to find. Oldtime gardeners and plant breeders like Lemoine in France have long since left this world, and there seem to be few who are equally talented, to replace them. I wish that some of my European acquaintances who have put so much time into hybridizing new roses would pursue other kinds of plants. Fortunately, the breeding of woody ornamentals is attracting greater interest in the United States. In addition to "free-lance" plant breeders, a number of institutions are now

(*Concluded on page* 64)

NEW PLANTS FROM EXPLORATION

Collection, propagation, testing and acceptance by growers are steps between discovery and introduction

Francis de Vos

U. S. National Arboretum

Fall flowering is the feature of this relatively tender cherry (*Prunus cerasoides*), discovered in Nepal in 1962. The U.S. Department of Agriculture plans to make it available for planting in the southeastern United States.

AN event of great significance to ornamental horticulture in this country occurred in 1956. The first of what was to be a series of explorations for ornamental plants was initiated in that year under a cooperative agreement between the U. S. Department of Agriculture* and Longwood Gardens.** The New Crops Research Branch (formerly known as the Plant Exploration and Introduction Division) of the Department of Agriculture was selected to administer this new program.

Explorations were made to southern Japan in 1956; Italy, southern France, Spain, Portugal, England and Scotland, 1957; southern Brazil and adjacent regions of Argentina, 1958; The Netherlands, West Germany and Belgium, 1959; Australia, 1960; northern Japan, 1961; and Nepal in 1962. Several thousand different kinds of plants have been brought in as a result of these expeditions and these are now in various stages of being distributed to botanical gardens, arboretums, experiment stations, research workers and commercial nurserymen.

Unlike plant explorations of the 19th and early 20th centuries, the prospect of finding new species of major importance

*Agricultural Research Service, U.S.D.A., Washington, D. C.

**The Longwood Foundation, Inc., Kennett Square, Pennsylvania.

U. S. National Arboretum

A recently introduced bamboo, *Sinarundinaria murielae.* It forms heavy clumps instead of spreading widely, and is expected to be hardy up to Washington, D. C.

was not good. Offsetting this was the promise that the gardens and nurseries of western Europe and Japan would yield many elite cultivars (cultivated varieties) and hybrids that would be new to American horticulture. This proved to be true. But wild species, even if previously introduced, were not to be overlooked. The emphasis in collecting from the wild was placed on obtaining the widest possible range of ecological types and, when possible, superior forms. Dr. John L. Creech's collections of such familiar plants as, for example, *Ilex crenata, Euonymus fortunei, Camellia japonica,* and *Rhododendron japonicum* have provided not only superior selections, *per se,* but also a reservoir of valuable characteristics that may at some future time be blended through breeding to produce hybrids of outstanding horticultural merit and a wide range of adaptability.

Exploration and introduction are but the first steps in a long chain of events for the plant that eventually becomes established in the nursery trade. First, seeds must be germinated, cuttings rooted or scions successfully grafted. Failures in propagation are not uncommon and may bring a speedy end to many potential introductions.

When successfully propagated, stocks must then be increased so that plants may be tested and evaluated under a variety of climatic conditions. Losses in shipping, cultural neglect, or extremes of cold, heat or drought before plants become established may take toll of many promising new plants. The most unpredictable factor along the way is the reaction of the nursery trade and the public toward a new introduction. Many fine plants have languished for years in botanical gardens and arboretums because nurserymen were unconcerned about adding such new plants to their stocks or because the public was not yet interested. The fast-growing bigeneric hybrid *Cupressocyparis leylandi* was introduced to this country about thirty years ago, but only in the last few years has it been available from a nursery source. The dwarf form of the Chinese holly (*Ilex cornuta* 'Rotunda'), so highly esteemed today, was first noted about 1920, but it was not until the Holly Society of America popularized the growing of holly in the mid-1950's that there was any demand for this plant. The Callery pear (*Pyrus calleryana*), after nearly fifty years, is only now receiving the attention it deserves.

The plants mentioned below are in various stages of being distributed, tested and evaluated, and they represent only a small fraction of the thousands that have been introduced through this cooperative program. Introductions from Australia and southern Brazil are not discussed here since they will be generally limited in their use to conservatories, the Hawaiian Islands and the warmer parts of Florida and California.

From Dr. Creech's plant explorations in Japan in 1956 and 1959 have come such interesting plants as the evergreen holly (*Ilex liukiuensis*), which produces prolific amounts of bright red berries; a variety of the beauty-berry (*Callicarpa japonica luxurians*) which bears an abundance of purple berries far surpassing the production of forms of this species previously introduced; the late-blooming

Hirado azaleas with flowers 5 to 6 inches in diameter, that have been in existence for possibly five hundred years in Japan; and a collection of *Rhododendron japonicum* representing many biological types that should be useful in breeding programs with other deciduous azaleas. In addition, his extensive collections of *Camellia japonica* from the entire range of its distribution in Japan, including the Kominato area (the northern limit of this species in Japan) and Kessennuma (a cold, dry area), may prove to be very valuable in a breeding program to increase the hardiness of camellias.

In 1957 and again in 1959, Dr. Frederick G. Meyer, formerly of the New Crops Research Branch, now in charge of the Herbarium at the U. S. National Arboretum, collected extensively in the arboreta, botanical gardens, nurseries, and private gardens of western and southern Europe. Included in his collections was a very interesting group of low-growing cotoneasters that will be useful as ground covers. *Cotoneaster dammeri* 'Skogsholmen' is a low spreading evergreen cultivar that originated in Sweden. Its leaves are ½ to ¾ of an inch long and the fruit is coral-red. *Cotoneaster* 'Sakdan' is a hybrid between *C. dammeri* and *C. salicifolia*. The leaves are long and narrow, the branches prostrate and the fruit orange-red. *C. salicifolia* 'Parkteppich' is a low spreading evergreen shrub with nearly prostrate branches and narrow leaves. *C. watereri* 'Herbstfeuer' forms carpets over the ground, its branches rooting readily at the nodes. The leaves of this cultivar are 1½ to 2½ inches wide and glossy dark green. The fruit is red.

Dr. Meyer considered the clump-forming bamboo, *Sinarundinaria mureliae,* to be one of the most important introductions of his 1959 trip. He says of this species, "A handsome plant more than 50 years old, in the nursery forms a solid clump about 10 feet in diameter with hundreds of culms 10 feet tall with a graceful arching habit. This bamboo seems to be fully hardy in the latitude of Washington, D. C., so for the first time we have a non-running bamboo for gardens and for potential economic use in middle latitudes of the United States."

U. S. National Arboretum

A red-fruited gourd of ornamental value, collected in 1962 in Nepal, here examined by a young Sherpa guide.

The 1962 plant exploration trip to Nepal by Creech and de Vos was more in the tradition of the early explorations of Ernest Wilson and others to the Orient in that it provided an opportunity to explore wild areas far removed from exotic ornamental plantings. Some of the more interesting plants introduced as a result of this trip are:

Prunus cerasoides, a fall-blooming cherry that rivals the Japanese flowering cherries in the showiness of its floral display. It would seem that there are areas in the southeastern United States where this species would be an effective ornamental tree.

Gaultheria fragrantissima, a broad-leaved evergreen shrub that grows to about 6 feet in height. The new growth and petioles are red, making a pleasing contrast with the somewhat wrinkled and glossy dark-green foliage. The fruit is an attractive bright blue. This species should be hardy in Zone 7 (—10° to 0°).*

Euonymus theifolius, a small evergreen tree growing to approximately 30 feet in height. It produces great quantities of

(*Concluded on page* 64)

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*Plant hardiness Zone Map, Miscellaneous Publication No. 814, Agricultural Research Service, U.S. Department of Agriculture.

LAKING (*Continued from page 32*)

8. Water, and allow to drain thoroughly.
9. Place additional soil around plant, leaving a dished area to facilitate future watering.
10. Mulch with organic matter and do not be concerned because the subsoil ended up on the top. The best soil is adjacent to the roots where it will encourage development of new roots. If the soil is light-textured, sandy or gravelly, both the topsoil and subsoil will benefit from additions of peat or other organic material, before it is placed around the roots.

Pruning at Planting Time

It is appropriate to assume that shrubs handled with bare roots have lost one-third to one-half of their root systems. It is to compensate for this that the branch system should be correspondingly reduced. Pruning at planting time generally involves the following operations with sharp secateurs (pruning shears):

1. Roots which are damaged in lifting should be cut back to solid clean tissue.
2. Long straggly roots not furnished with fibrous roots should be reduced in length to encourage development of fibrous and hence feeding roots.
3. Shoots and branches should be reduced by about one-third on the average. This may take the form of thinning if the shrub is bushy, or cutting back, if the shrub has a thin branch system. Usually a combination of thinning weaker shoots and cutting back is required. Cuts should be made just above the node which bore a leaf, assuming the shrub is deciduous.
4. Familiarity with the natural growth habit of the shrub will help in judicious pruning at planting time.

Subsequent Care of Shrubs

Recently planted shrubs should not be allowed to dry out. Surface mulching with garden compost or with a mixture of compost and peat will materially reduce soil moisture losses and of course will remove cultivation of shrubberies from the garden maintenance roster. If materials such as wood chips or sawdust are used for this purpose, nitrogen fertilizer will be required to offset the effects of nitrogen starvation, inevitably associated with such mulches. Where growth remains slow, a spring application of balanced commercial fertilizer will promote a more desirable level of growth. In poor soil this is an annual requirement, but in better soils one's judgment is needed, because over-fertilization may cause excessive stimulation.

Pruning is an annual requirement of many shrubs, and if done judiciously, it reduces the necessity for periodic onslaughts. The renewal type of pruning, which basically involves removing some older wood annually right from the base of the shrub encourages new growth.

Neglected shrubs can be completely rejuvenated over a few years by removing from the base a proportion of old wood each year, thus encouraging the development of new shoots from the base of the shrub. In addition to removal, the remaining branches should be reduced in length to good lateral shoots. If excessive new growth is promoted in any year during the renovation process, this should be thinned by removal of the weakest. (For more specific direction on the pruning of established shrubs, see page 62. Detailed procedures for all types of garden plants are given in the Botanic Garden's *Pruning Handbook*, No. 28 in the series listed on the back cover.)

Shrubs which have been grafted may produce suckers from the understock. These are usually obvious because of their rapid growth and their foliage differing from the shrub with which they are associated. As soon as they are noticed, suckers should be removed from below the surface of the soil.

Flowering shrubs as garden residents require their share of care, yet it is remarkable how they perform year after year with a minimum of attention. The fact is that many could be superb rather than mediocre, if good culture were practiced. Such an objective is a basic attribute of good gardening.

WHAT KIND OF SHRUB? WHAT TYPE OF PRUNING?

Die-back shrubs. Prune to ground level in spring.

Caryopteris
Elsholtzia stauntoni

Shrubs of borderline hardiness in some areas. Check for winter killing in spring and cut out all dead wood when these shrubs are grown north of their usual range.

Abelia grandiflora
Clerodendron trichotomum
Cotoneaster
Cytisus battandieri
Diervilla
Deutzia
Indigofera incarnata alba
Kerria japonica
Leycesteria formosa

Summer bloomers. Prune last year's wood to two or three buds in spring.

Hibiscus syriacus
Hydrangea
Lagerstroemia indica
Spiraea bumalda

Shrubs requiring pruning after flowering. In general, remove oldest shoots to encourage new growth.

Abeliophyllum distichum
Acacia farnesiana
Ceanothus
Forsythia
Hibiscus rosa-sinensis
Lindera benzoin
Philadelphus
Spiraea prunifolia
Spiraea trichocarpa
Spiraea vanhouttei
Jacobinia ghiesbreghtiana

Prevention of seed formation desirable. In general, remove only spent flowers to conserve plant energy.

Rhododendron (azalea)
Syringa (lilac)
Pieris floribunda

For other flowering shrubs that are mentioned in this Handbook, no specific directions are given, for they require little or no special pruning skill.

* * *

HARKNESS (*Continued from page* 15)

with the unfolding leaves, early May in Rochester, New York. Bright red fruits ripen in June, though the lack of pollinating insects at flowering time prevents any abundance of them. With its less than 6-foot height, it is in a useful class of shrubs. Year-old stems are brown, older branches gray, with some exfoliation and are arching. Its quick response to the most tentative approaches of a northern spring would be welcomed by winter-weary gardeners.

Variegated Kerria

Many variegated-leaved shrubs are rather strident in effect, but daintiness is the quality that seems most descriptive of the variegated kerria (*Kerria japonica* 'Picta'). Leaves of kerria are variable in length from 1 to 4 inches, part of the length being an extended point to the generally ovate blade, which has a jagged, doubly-serrated margin. When irregular white variegation is added, the plant is crisply attractive all summer. Excellent contrast is given by the clear yellow flowers which, like miniature single roses, come and go on the tops of the branches intermittently from June on.

Questions of hardiness and endurance are frequently raised about kerria in general and the variegated form in particular. The Rochester plant came five years ago from central Pennsylvania where it is colder. Its position in half-shade, in rather heavy unfertilized soil, where it is watered only in extreme drought presumably keeps it from producing any lush, winter-tender growth. It seems to make more of a mounded bush in contrast to the suckering canes of the typical kerria.

Sweet-shrub

Homespun fabrics are much to the liking of many; I see something of the same quality in an old familiar shrub which has acquired such folk-names as sweet-shrub, strawberry-shrub and Carolina allspice (*Calycanthus floridus*). This plant of the Appalachian mountains can be recommended as sturdy in character and reliably hardy. A sweet aromatic fragrance pervades the whole plant from the large, rather rough and coarse leaves, downy underneath, to the stems and roots. A smooth-leaved species, *Calycanthus fertilis*, co-existent in the wild and in nurseries is less apt to have fragrance in leaves and flowers. Horticultural selections should be made to bring out the best in flower fragrance and dwarf habit.

LEGENDRE (*Continued from page* 58)

carrying on breeding programs. Indeed, the remarkable semi-weeping crab apple 'Red Jade' came from the work of the late Dr. George M. Reed of the Brooklyn Botanic Garden. Among other institutions devoting part of their effort to plant breeding are the National Arboretum, University of Illinois, Arnold Arboretum, Boyce Thompson Institute, and the Ida Cason Calloway Gardens in Georgia. A number of private individuals are also engaged in breeding rhododendrons and magnolias.

While I have limited my list of introductions to European novelties, I might add some of the good American shrubs such as Forsythia 'Beatrix Farrand' and Bignonia 'Yellow Trumpet' which I have had the pleasure of helping to introduce.

In connection with the introduction of new plants, I ought to say that several able nurserymen have been criticized for promoting previously known plants under changed names. While I realize the importance of botanical names and believe they should appear with all new introductions, I have been in touch with the American public long enough to realize that unless a new plant is being offered under an attractive and imaginative yet good descriptive American name, it will be very difficult to interest people in it. I could mention many good plants which never become popular for this very reason. One of them is *Caryopteris clandonensis,* which was offered for many years by a very reputable firm. It could not be sold. Another nursery, just as reputable, added the name 'Blue Mist' and it has since been planted by the thousands.

DE VOS (*Continued from page* 61)

spherical fruits that are ½ inch or more in diameter and very showy at the time that the bright orange seeds begin to protrude. On the basis of its natural distribution in the wild at from 6,500 to nearly 9,000 feet, this species should be hardy in Zone 7.

Luculia gratissima, a shrub that grows to about 16 feet in height and has soft pink fragrant flowers in the fall. This shrub would be hardy only in the Hawaiian Islands and warmer portions of Florida and California.

Trichosanthes palmata, the most spectacular plant collected, a perennial gourd-vine with bright red fruit 5 to 6 inches long. This would be highly ornamental if trained on a trellis. Although this species was found at a low elevation (5,600 feet) where the climate is almost subtropical, it may be satisfactory for many of our southeastern states.

It is impossible to predict which of the hundreds of introductions will become important in American horticulture. Some undoubtedly will not make the grade. Others may be useful only as they contribute valuable germ plasm to breeding programs designed to improve other species. This is no minor contribution, however, for only through breeding may it be possible to fortify insect and disease resistance, increase hardiness and significantly enhance appearance of many of our ornamental plants. There is promise, however, that some of the introductions will contribute to the enrichment of ornamental horticulture in this country.

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Summer
1964

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NEW SERIES
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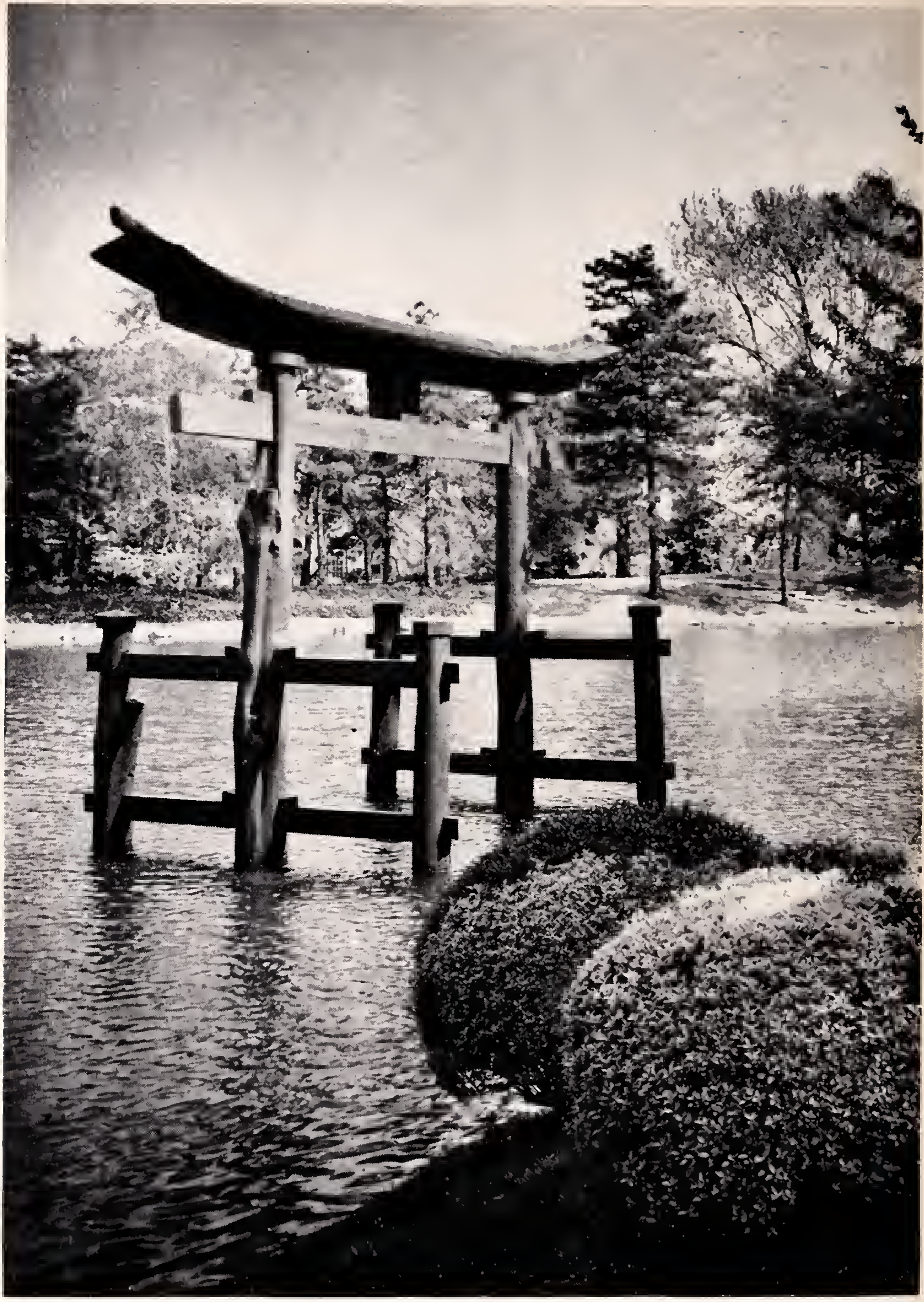

Gottscho-Schleisner photo

Japanese influence on structures in American gardens. This Torii, which indicates the presence of a shrine or temple nearby, stands in the Lake of the Japanese Garden at Brooklyn Botanic Garden.

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES
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Summer 1964

How does one distinguish between a garden structure that is in good taste and one that doesn't quite measure up? Where does one look for guidance on building garden walks and fences, or paving terraces? This Handbook does not pretend to answer all questions, but we hope it will be helpful as a source of ideas.

To be good—structures, which are static, must be in constant "tune" with the plantings, which are always changing.

The best advice of all is . . . "Proceed with caution." Before deciding the final details of construction, particularly when it comes to accessories, it is often desirable to "live with" a garden for a while. For the most pleasing effect, use restraint. An over-furnished garden can be as pathetic as an over-furnished living room. If the urge is to add "just one more thing"—be sure it does not ruin the whole picture.

How does one plan or design a "photogenic" garden? Perhaps the answer is to take a picture of your existing garden and then try to evaluate it from the standpoint of charm, good taste, etc. Here at the Botanic Garden we have commissioned some very fine landscape architects over the years to design special gardens, and to keep us from making mistakes in the over-all plantings. Many results have been excellent, but this does not mean that there is a picture at every turn.

Landscape Architect Mary Deputy Cattell consented to be Guest Editor of this Handbook and Paul Frese has helped it take shape. Their watchwords are . . . plan a garden and accompanying structures for easy care, but use great thought in the planning. Not everyone will choose the same materials, but all will wish to have structures in harmony with the garden pictures they aspire to create.

Sincerely,

George S. Avery, Jr.

Director

STEPS FOR GROUNDS AND GARDENS

What kinds to use and how to build them

STEPS are obviously a means of getting from one level to another. They may be set in a wall or in a bank. The material, design, and construction should be appropriate to the architecture or the landscape around them. Steps should be made of material that is easy to get and to build in the immediate locality, and the construction should be safe, durable, and easy to maintain.

Kinds of Steps

Steps may be of brick, stone, concrete, wood, grass, or a combination of two or three of these. Outdoor steps, as a general rule, should be much shallower in riser height and broader in tread than any indoor steps. Where there is a slight drop in grade, or in a gently sloping bank, a riser height of 4 inches with a tread of 18 inches is ideal. A 5-inch riser should have a 16-inch tread, a 6-inch riser a 15-inch, and a 7-inch riser a 13-inch tread. The 7-inch riser should be used only where there is a considerable amount of height to be gained and not much horizontal space in which to do it. Usually, it is advisable not to have more than 6 inches in riser height.

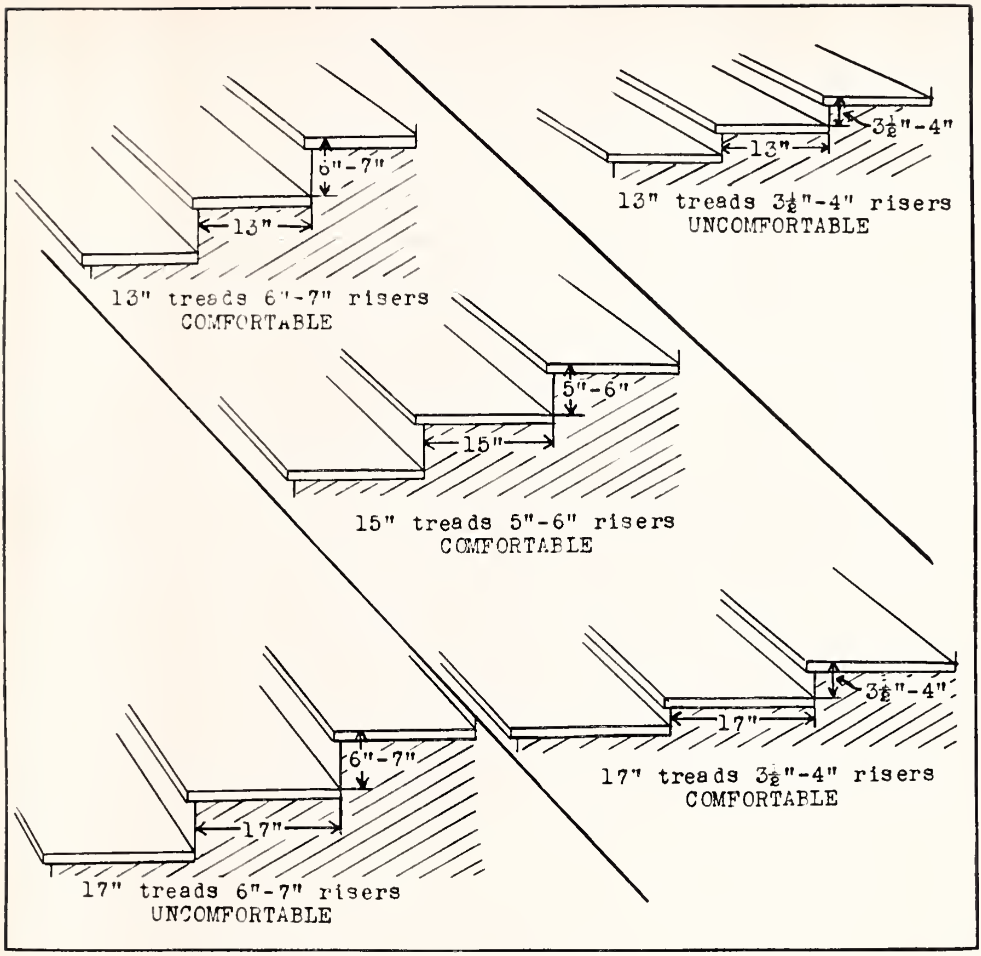
Steps built in a bank should be so planned that they are one riser height out of the slope throughout the entire length. This will prevent the soil of the bank from washing out all over the steps with every rain. It requires a little extra finishing on the end of each tread but is sound practice.

The steps in a retaining wall may be built back of the front surface of the wall receding toward the higher grade, or may start at the edge of the retaining wall at the top and extend over the lower grade. The latter, if there are more than three steps, will require an additional wall at the side for safety, called a wing wall. This usually makes a more formal-looking flight of steps; and if there are several flights that can be seen from a lower level, it gives a rather monumental appearance. If the steps are set back into the upper grade, it is usually more attractive to extend the lowest riser beyond the face of the wall and make it a little wider than the upper steps. This is particularly important where there are five or six steps. If there are more than that, the first two risers should extend in front of the wall.

The type of steps to choose depends largely on the surroundings. If the retaining wall is of brick, flagstone treads with brick risers will probably look best. If it is a stone masonry or carefully laid dry wall, the steps may have flagstone treads and stone risers. For a cruder type of dry wall, large native stones laid in dry will be most effective. With such a wall, grass steps or log or plank steps may look perfectly in keeping and of course are usually less expensive to build. In informal areas like water gardens, wild gardens, rock gardens, or woodlands, steps of logs or large native stones look much more at home than any built of the more formal materials. In open lawns, where the slope is very gradual, grass steps with board edges are least noticeable and make the transition down a grade most imperceptible.

Construction

Masonry steps are built on concrete or rubble foundations. The excavation is made in steps or on a slant, as indicated

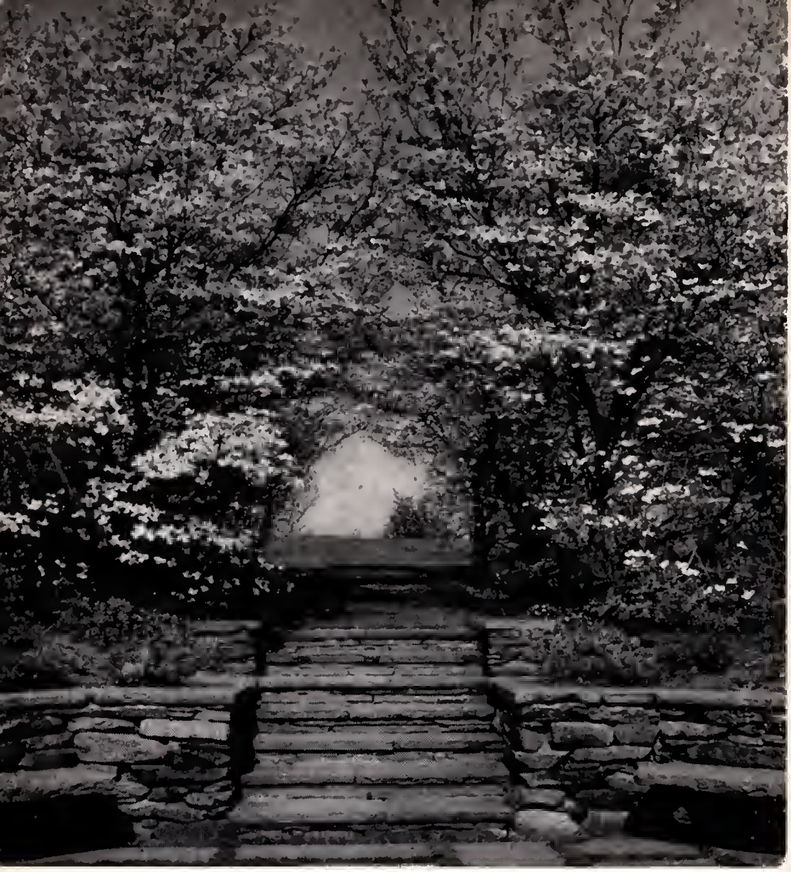


Good and bad proportions of risers to treads.

in the drawing. The foundation for the bottom step should be 18 to 24 inches deep. The riser, or front, of the step may be of stone or brick. The tread, or top, of the step is better made of flat flagstone or slate, projecting 1 inch in front of the riser. Brick treads are acceptable but likely to wear in the mortar joints and allow frost to penetrate.

Grass steps and ramps must be carefully constructed for safety and for easy maintenance. The front, or riser, of a turf step should be no more than 4 inches high and may be of wood planks, treated with preservative, thin slabs of flat stone with flat top edges and fronts, granite blocks, or brick.

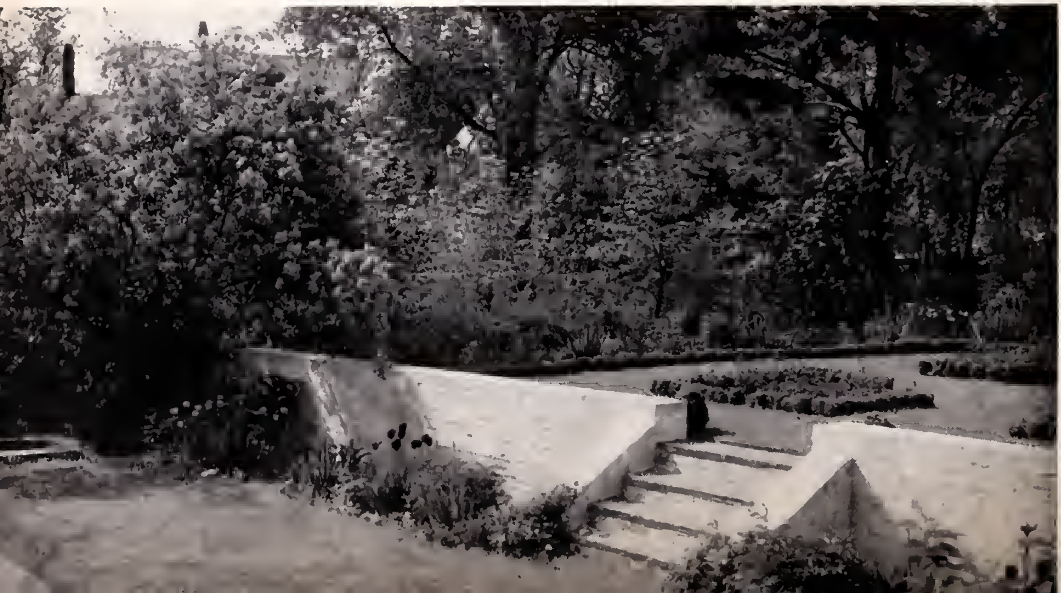
Wood risers should be pegged into the step at each end and be set in the ground at least 4 inches. Stone risers should be set in concrete 12 inches deep unless the stone itself is wide enough to extend at least 9 inches below the grade of the step. Brick risers should be set in 12 inches of concrete for safety. Otherwise constant use will loosen them and make them very dangerous.

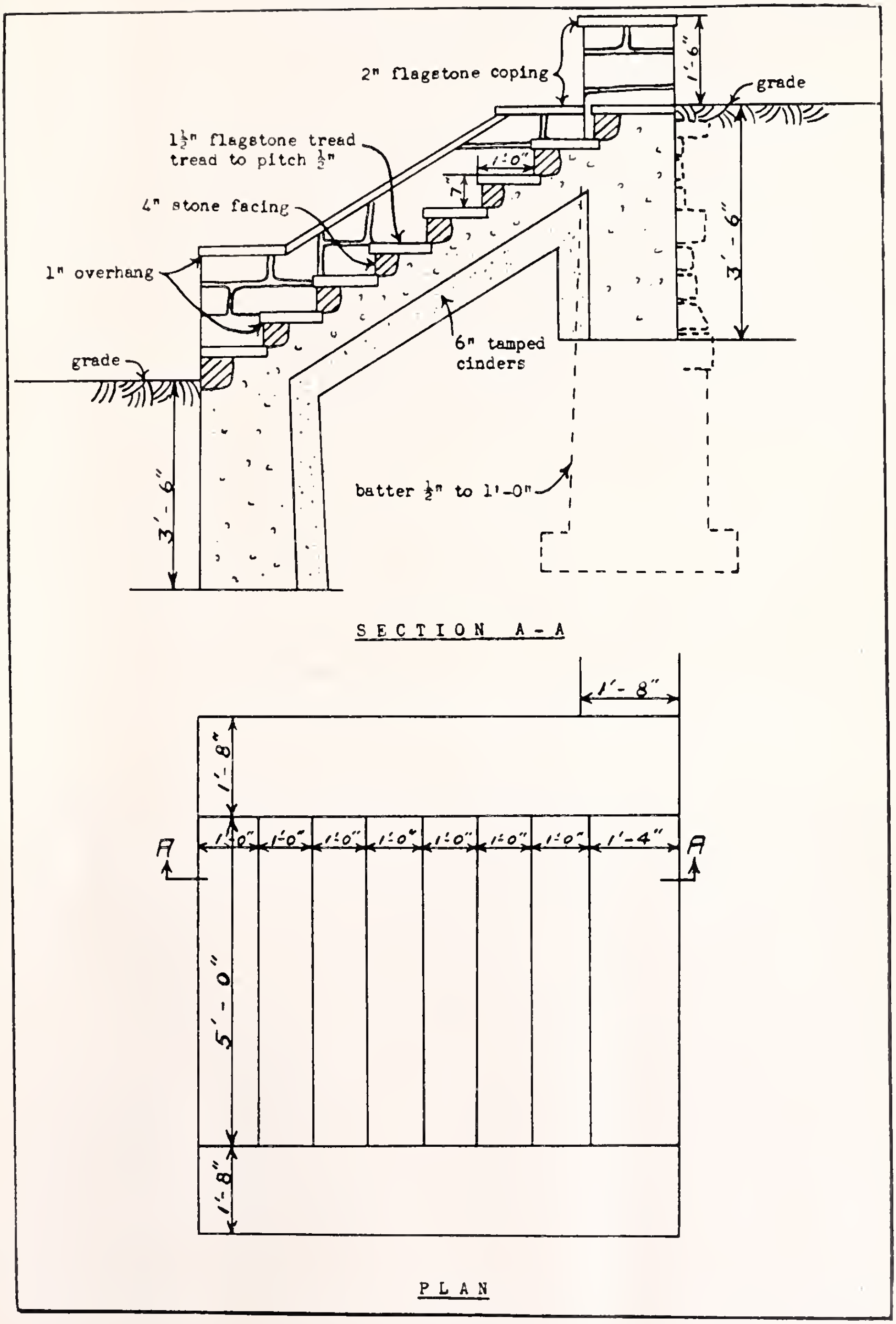


Flagstone treads and stone risers tie in perfectly with the dry wall. The pair of dogwoods at the top of the steps adds greatly to the invitation and graciousness of the steps.

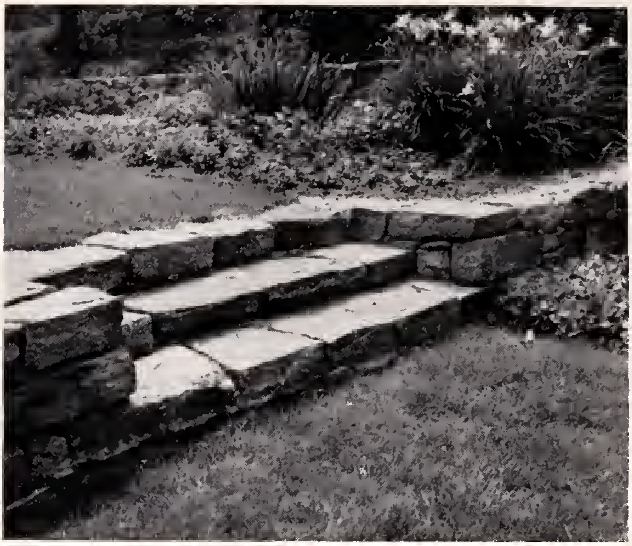
L.A. Florence B. Baker *R. A. Smith photos*

The brick risers of these steps are appropriate to the brick wall adjoining. The flagstone treads give contrast of color and greater permanence than brick treads.





Construction details of steps with wing walls.



There is a comfortable proportion between low riser and deep tread in these stone steps. Note that the front step is flush with the face of the wall.

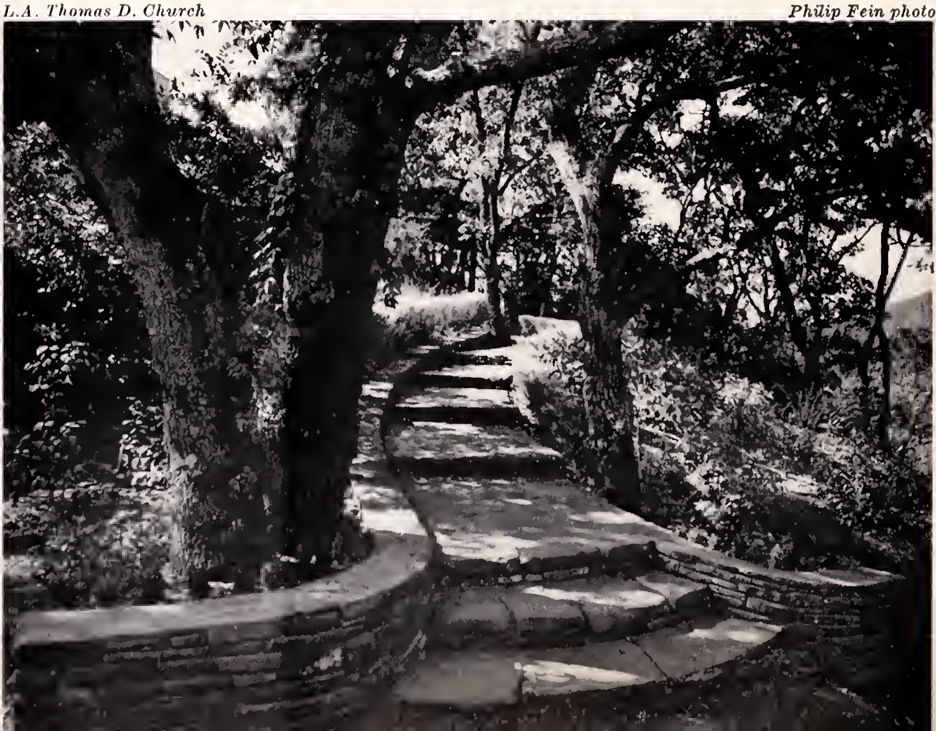
T. H. Everett photo

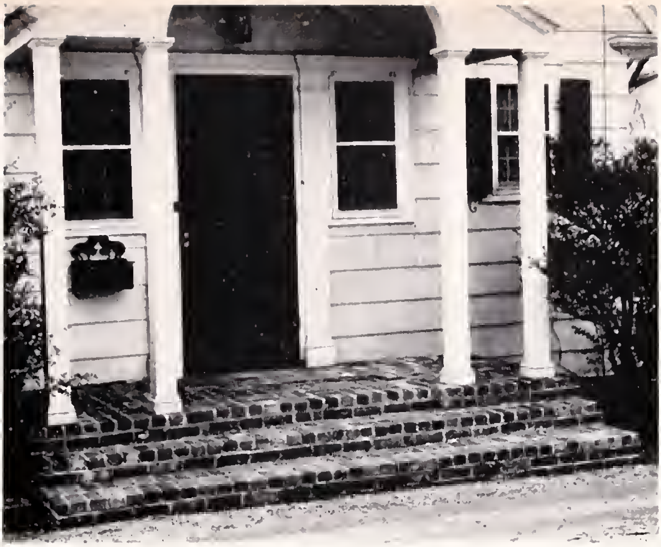
The treads of grass steps should be at least 24 inches deep to allow the lawn mower to run on them. The same type of construction is used for ramp steps. Their depth (distance between risers) depends of course on the slope, but for comfort the ramp pitch should not be greater than 1 inch for each foot of depth.

Grass on either steps or ramps must be of fine quality. The topsoil should be at least 8 inches deep, well fertilized and sown with a wear-resistant grass mixture, or sodded with clean, strong turf. The mixture differs with climate and local conditions; local seed stores or greens keepers will usually advise which formula is best.

The sweeping lines of walk and adjoining walls have been designed and executed with great skill. Note the well spaced steps.

L.A. Thomas D. Church *Philip Fein photo*





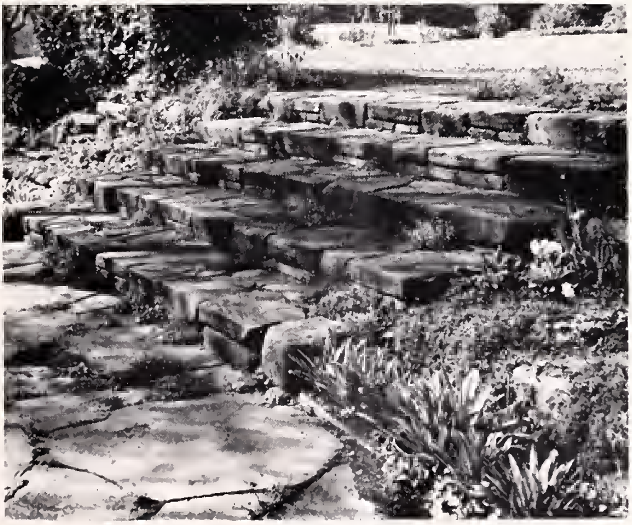
An entrance porch of old brick laid in cement is appropriate to a small traditional house.

L.A. Alice Recknagel Ireys

Buhle photo

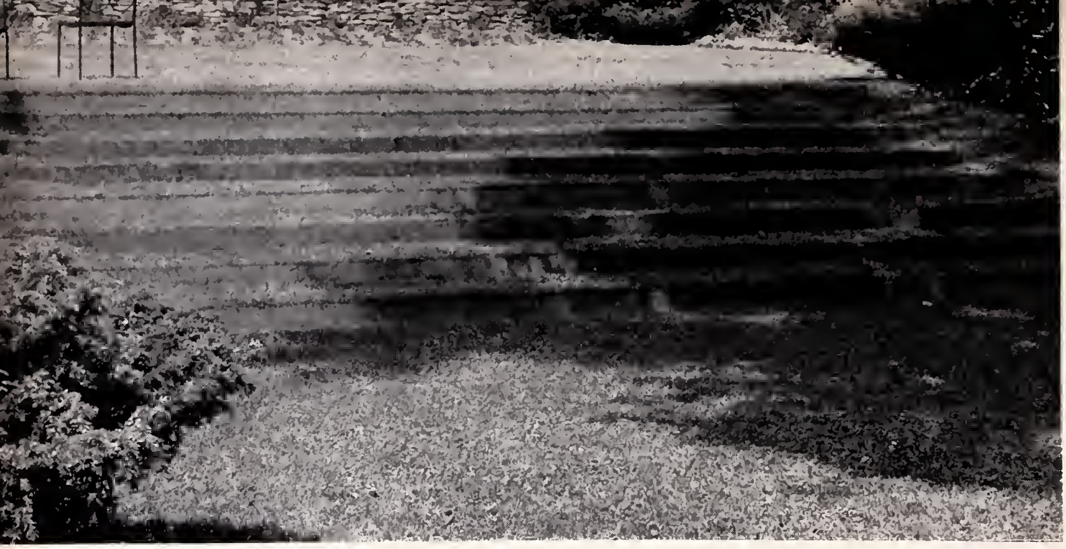
Log steps are best built with a 6-inch riser formed of split logs with the split face exposed. These logs should be 8 inches in diameter, sunk into the earth 2 inches, and the ends pegged firmly into place with wooden stakes about 18 inches long, driven down to finish flush with the top of the step. The wood should be treated before setting with a pentachlorophenol or copper naphthenate preservative (see footnote, p. 34), applied according to manufacturers' directions. The treads may be formed of (1) good topsoil, tamped firmly so there will be no settling, and then sodded with first-class sod free from weeds, or (2) brick or flagstone laid on sand and cinders as described under paving. Old railroad ties are excellent for this type of step.

Board steps are built of heavy planks not less than 2 inches thick, treated with a preservative, and supported on either end by wooden stringers as for indoor steps, or let into the adjoining bank and pegged in place at either end.



By alternating smaller with larger stones, this wide flight of steps blends well with the bank planting without being ponderous.

John Robinson photo



R. A. Smith photo

A very wide flight of steps makes the transition between two lawn levels easy and inconspicuous. The steps have grass treads with risers of weathered boards.

Planting Near Steps

Planting near a formal flight of steps can do a great deal to soften its lines or to give it more apparent width. Steps in a bank usually need planting at the edges to soften the transition from stone or wood to earth. The planting must be carefully chosen and put far enough back from the edges of the steps so that it will not, in the course of two or three years, almost close up the opening.

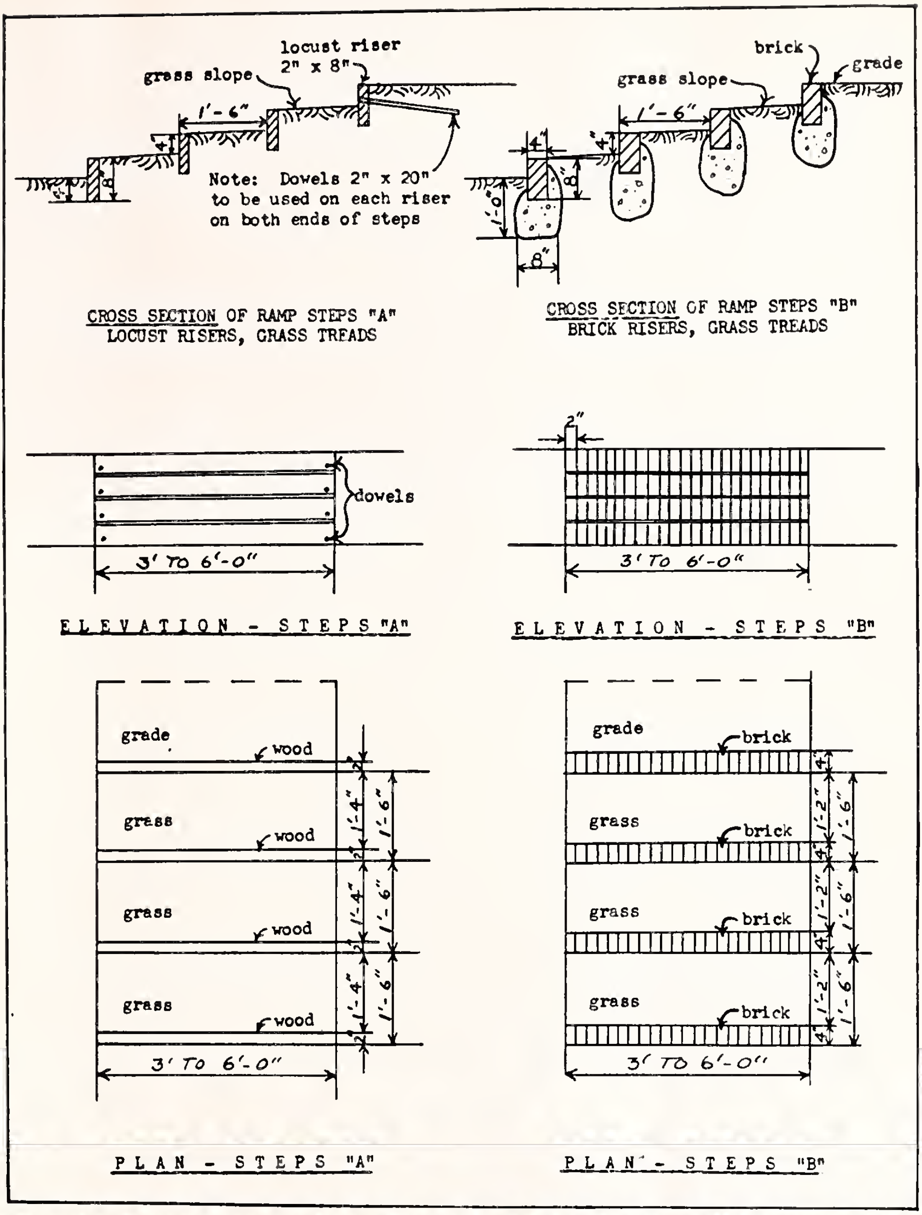
This is a perfect location for low-growing ground-cover shrubs like some of the dwarf cotoneasters or spreading yews (*Taxus*) and junipers (*Juniperus*). If ground-cover plants are used too near the steps, great care must be taken to keep them off the treads. They make very unsafe footing and are likely to trip the passer-by.

Where two or three steps project in front of a retaining wall, a low substantial bush on either side can take the place of a wing wall. The wing wall is not actually necessary for safety, but steps projecting in mid-air have an insecure look.

Plants suitable for such purpose are low dwarf boxwood (*Buxus sempervirens suffruticosa*), dwarf holly (*Ilex crenata convexa*), evergreen barberry (*Berberis julianae*), dwarf flowering quince (*Chaenomeles*), dwarf winged euonymus (*Euonymus alata compacta*), and Japanese pieris (*Pieris japonica*), often wrongly called andromeda. All of these have a rather regular and compact form.

When the flight of steps projects entirely into the lower level and wing walls are required, a spreading and picturesque shrub or small flowering tree on either side of the wing walls will make them seem less intrusive. Sometimes vines over a series of wing walls will soften them enough to make them almost unnoticeable.

If the flight of steps from one level to the other is necessarily of eight or ten risers and, therefore, rather imposing, a pair of flowering trees at the bottom of the steps will do much to dwarf their height and make them seem less formidable. On the other hand, if the flight of steps is low in comparison with a tall house or a very tall wall or hedge behind them, a similar pair of trees on the top of the wall or bank will increase their apparent height.



CROSS SECTION OF RAMP STEPS "A"
LOCUST RISERS, GRASS TREADS

CROSS SECTION OF RAMP STEPS "B"
BRICK RISERS, GRASS TREADS

ELEVATION - STEPS "A"

ELEVATION - STEPS "B"

PLAN - STEPS "A"

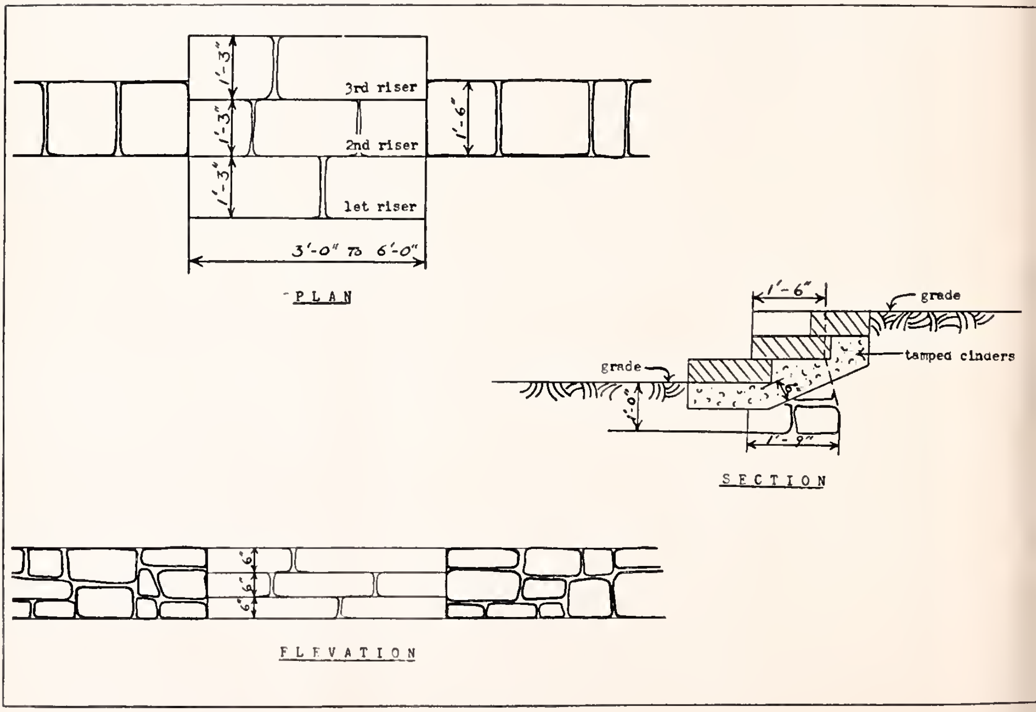
PLAN - STEPS "B"

Details of ramp steps with wooden and with brick risers. Wherever wood is used in contact with soil be sure to treat it with a preservative (see text).

R. A. Smith photo

Large native stones, cut square and laid without mortar, make fine steps in sections of the country where such stone is available. Large stones look substantial and stay safe and solid in severe climates.

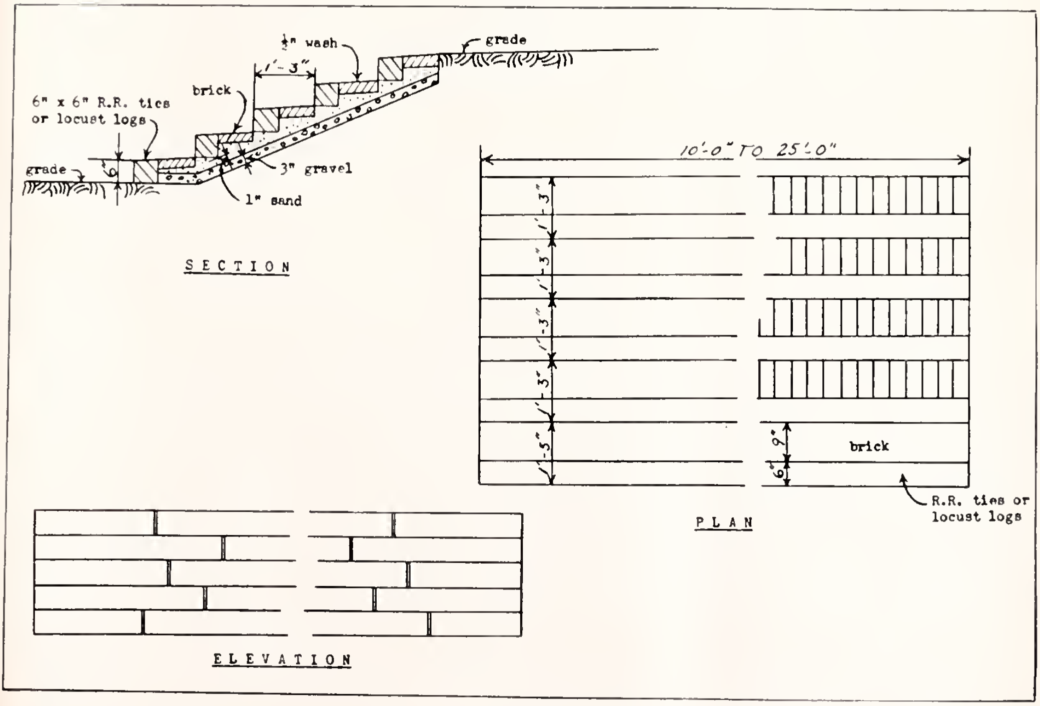
Detail of native stone steps.

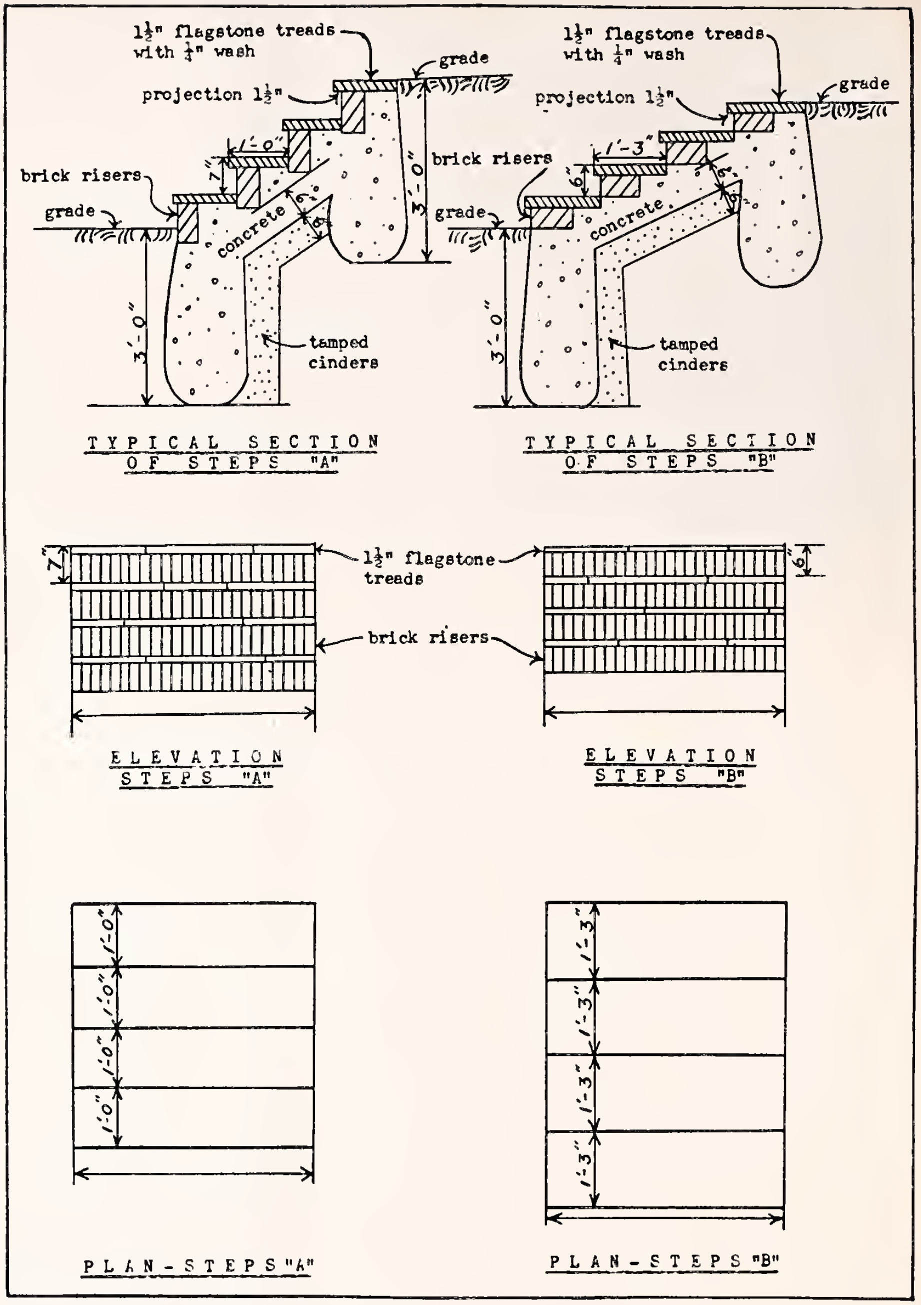


L.A. Thomas D. Church

Wooden steps and wall copings are in keeping with a contemporary house. All wood should be treated with pentachlorophenol (Woodlife or other wood preservatives containing phenol).

Detail of log and brick steps.





Details of brick and flagstone steps.

Gottscho-Schleisner photo

This curving grass path is inviting because of its width and neatly kept borders of low-growing plants, framed by flowing masses of shrubs and trees.

WALKS AND PATHS

Their location, construction, and planting

WALKS are, of course, essentially a means of circulation around the place. Their location, construction, and material, however, make a tremendous difference in the appearance, the comfort, and the upkeep of the grounds as a whole. Walks may be made of all sorts of materials—grass, tanbark, pine needles, wood, gravel, stone, brick, or concrete. Which kind is chosen depends largely on the use to which the walk is to be put, how much traffic it will have, its immediate surroundings—whether in woodland, in gardens, or near the house—and to a great extent on local climatic conditions.

Kinds of Walks and Paths

Certainly the least expensive to install but probably the most expensive to maintain is the **grass path.** Under any considerable amount of use the surface of such a path is certain to be worn thin and take a great deal of reseeding, fertilizing, and constant care. It is practical, usually, only in a flower garden for secondary paths or as a panel through the vegetable or fruit garden where there is very little traffic.

Any grass path that adjoins flower beds or other kinds of planting should have a defined edge of brick or flat stone for the lawn mower wheel to run on. Its width should be a multiple of the width of the hand or power mower on the property. In other words, if the hand mower has an 18-inch cut, the path should be 30 to 34 inches, so that two trips of the lawn mower complete the path. If there are grass paths of any considerable length on the property, careful planning of widths may make a difference of an hour or two a week and a great may feet of walking in weekly mowing.

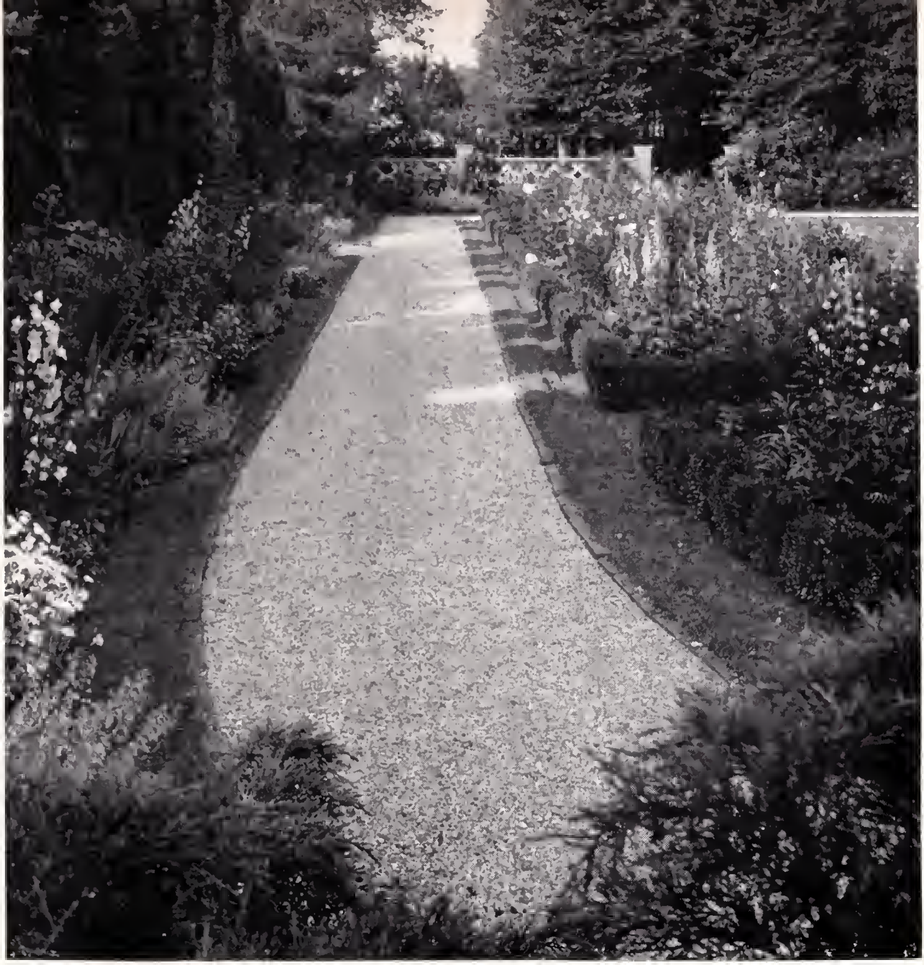
In informal gardens or in woodland plantings, **paths of tanbark, pine needles, buckwheat hulls, or crushed pecan hulls** are all most attractive and practical. The material used depends on its local availability. Such paths are not suitable for year-round use as they are inclined to be spongy and wet under foot during the spring thaws. They should have board, brick, or stone edges to keep the surface material from washing out into the adjoining lawns or planting sections. With their brown color they blend easily into adjoining landscape and earth colors. The surface needs renewal about every two years as it usually crumbles under use and weather.

Paths of wood blocks or rounds of wood are appropriate and desirable for informal gardens or where there is a woodland feeling. They should be treated with a wood preservative as discussed on page 34, and so treated will last for many years. They are inclined to be a little slippery in early spring and late fall, particularly if they are in heavy shade.

Gravel or crushed-stone paths with brick edges are the least expensive of the hard-surfaced paths to install and if well built, are easy to maintain. The color to be chosen depends on the effect desired and on the local stone or gravel colors. Usually gravel is more comfortable than crushed stone for the top surface. A great range of color can be had with broken

The yew hedge bordering this straight grass walk is planted far enough back that there is little danger of early encroachment.

Gottscho-Schleisner photo



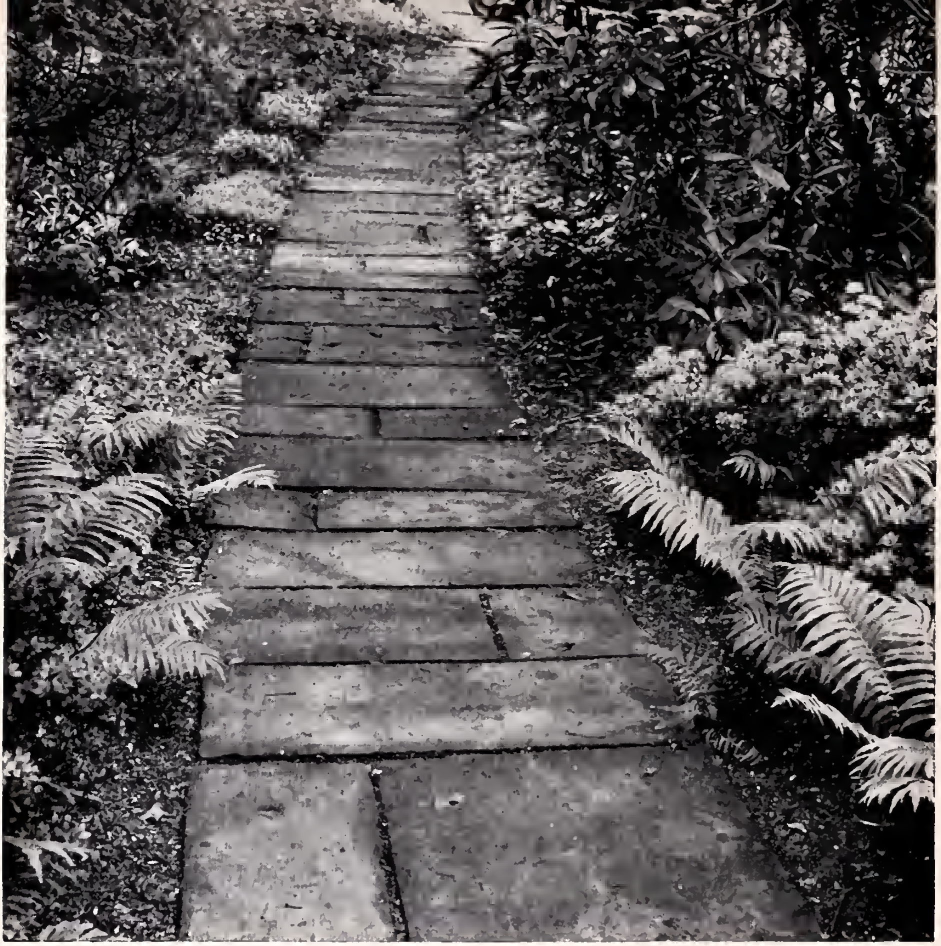
R. A. Smith photo

A well-constructed gravel path with a brick edge helps give pattern to this formal garden. The grass border is the width of a narrow lawn mower and gives greater dignity to the path.

bluestone, limestone, sandstone, and marble of various colors and textures. In a flower garden of intricate pattern, paths of white or yellow gravel or stone make the pattern stand out brilliantly and add to the formality of the garden. In an old-fashioned garden, dark-colored gravel, sparingly used, is reminiscent of the old dirt paths of country gardens.

Gravel paths are particularly practical in cutting gardens and vegetable gardens, and as the outside path of the flower garden. They allow the flower grower to get around his garden in the early morning dews without too much discomfort from wet feet. They also save a great deal of mud in the house during the gardening seasons of the spring and fall, when grass paths are too muddy to walk on.

Stone, brick, and concrete are suitable for the important or much-used paths on the place. Certainly the ones to the front door and the back door should be of these materials. They are more expensive to install than grass, gravel, or wood, but take almost no upkeep except an occasional sweeping, and perhaps the use of weed killer now and then on the brick

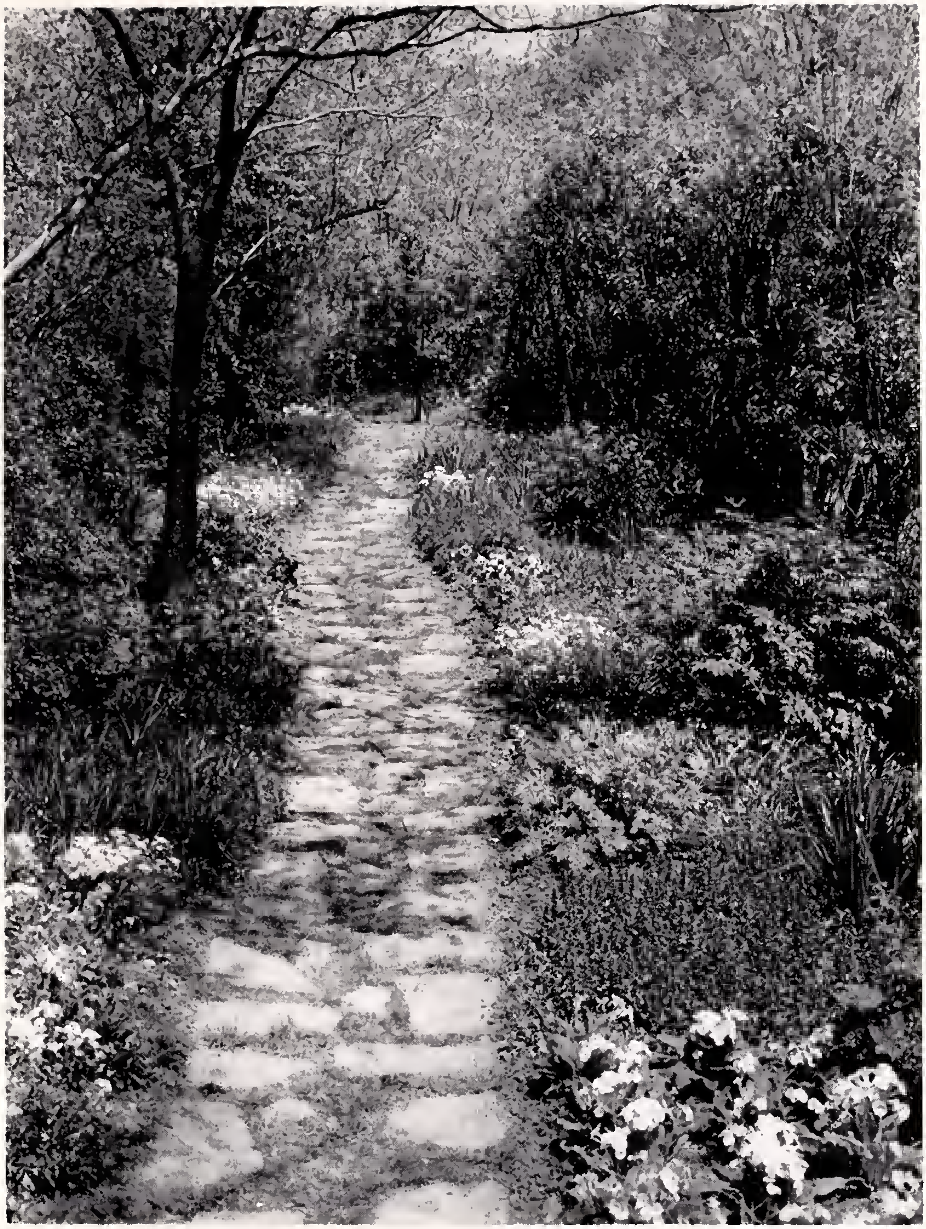


McFarland photo

Weathered flagstones laid closely together make a practical and appropriate walk in a shady spot. Simplicity of pattern and the use of relatively few stones add to its beauty.

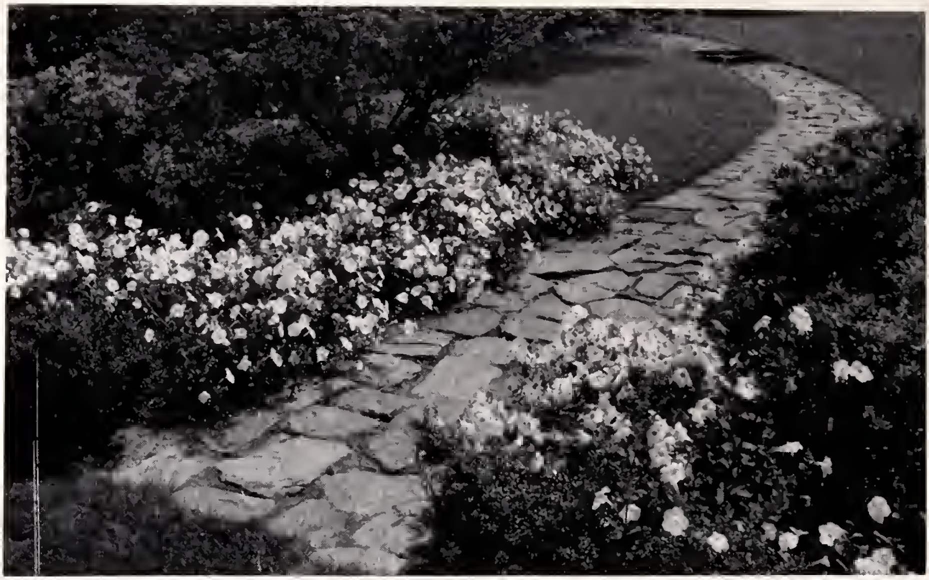
and flagstone. They have the added advantage of being easy to shovel in sections of the country where snow is likely to be a problem.

Stepping stones instead of solidly paved paths are suitable in some informal areas, or where inconspicuous surface is more important than really comfortable circulation. They may be of flagstone, native irregular stone, or wood rounds. Their chief disadvantages are difficulty of spacing and of upkeep. If they are properly spaced for a man, the average woman usually steps between them. If they are spaced close together they become a narrow walk rather than stepping stones. In wild gardens the plants around them are likely to cover them completely in an astonishingly short time. When they are in the lawn, constant hand-clipping is necessary, and in the course of two or three years much of their surface is below the turf level, and they are a hazard rather than a pleasure. They should be used with great caution, and with the knowledge that their upkeep is likely to far outweigh their initial economy.



Gottscho-Schleisner photo

Irregular broken flagstones are appropriate in a woodland setting. The shade keeps the grass from growing too rampantly in the wide joints, so the path is comfortable enough for one not too often used.

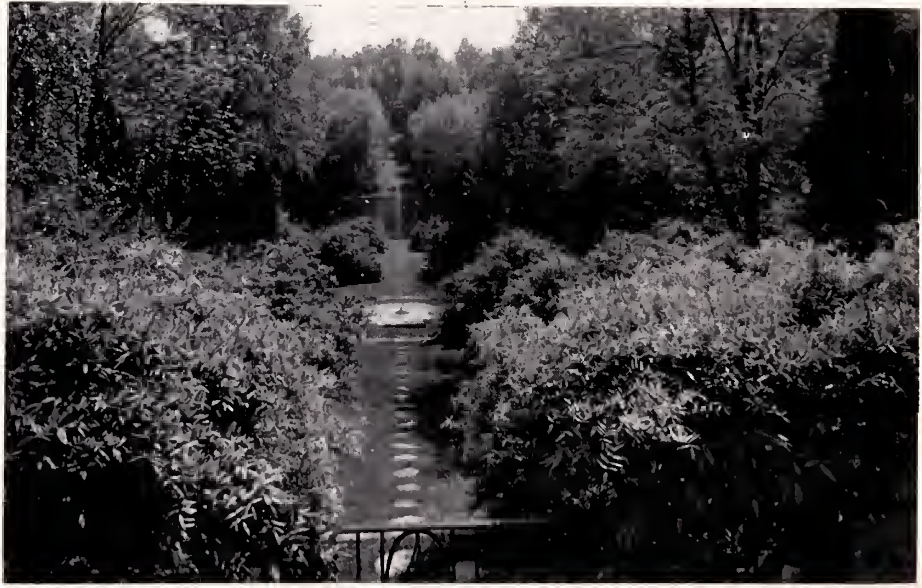


L.A. Mary Deputy Cattell *R. A. Smith photo*

Flat-surfaced native stone makes an interesting pattern in an informal walk.

Small irregular stepping stones are a distraction to the eye in an otherwise restful scene. They require considerable hand-clipping to keep them from being submerged in the lawn.

McFarland photo



Gottscho-Schleisner photo

Herringbone brick walk in an old-fashioned herb garden.

Dimensions and Construction

The width of a paved walk or path is determined largely by the amount of use it gets and the proportions of the areas adjoining it. The main paths to the front door and around the garden and to the garden should be wide enough for two people to walk abreast. This means that they should be not less than 3 feet 6 inches wide and are better if 4 or 5 feet wide. Service paths along which wheelbarrows or carts are likely to travel should be at least 3 feet in width. Paths narrower than this are likely to be uncomfortable, and if any planting adjoins them they will soon be overgrown and impassable in heavy dews or after rains. They should be constructed only where the size of a garden makes them imperative, or for little-used paths that must be inconspicuous as possible.

The construction of paths and walks is the same as described for paved terraces of the same materials. (See article beginning on page 25.)

Planting Near Walks

All walks adjoining grass should have the edges (whether of brick, stone, or wood) level with the sod, so the lawn mower wheel can run along the path and do away with the need of hand-edging. Where it adjoins flower or shrub beds, the edge of the path should be at least ½ inch above the earth of the bed. If mulches of clippings, peat moss, or buckwheat hulls are to be put over the planting, the edge of the path must be high enough to keep them from washing out into the path every time it rains or the planting is watered.

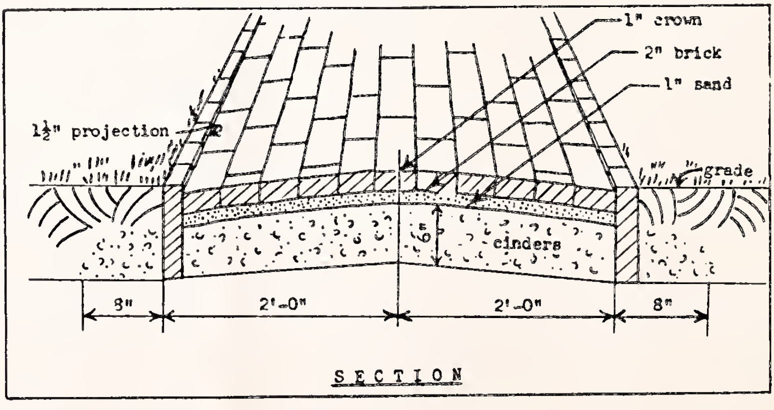
Edge plants. Planting near walks can be very troublesome. In a garden, whether a decorative or service garden, the edge plants must be kept far enough back to avoid narrowing the walk uncomfortably even at their season of lushest growth. At the same time they must be close enough to prevent a great expanse of bare soil, which would give the appearance of no edge at all. To accomplish both ends, annuals, perennials, and vegetables of tidy rather than sprawling habit are easier to manage. Dwarf petunias, lobelia, and ageratum are better than balcony petunias, sweet-alyssum (*Lobularia maritima*), or candytuft (*Iberis*) unless there is to be a considerable amount of shearing back all through the late summer. Gentian speedwell (*Veronica gentianoides*), coral bells (*Heuchera sanguinea*) and its hybrids, and candytuft Snowflake (a named variety of *Iberis sempervirens garrexiana*) soften the edge of a garden path without encroaching on it as do the ordinary evergreen candytuft (*I. sempervirens*), Hungarian speedwell (*Veronica latifolia rupestris*), creeping speedwell (*V. repens*), and Persian nepeta (*Nepeta musini*). With gravel or native stone paths, where weed-killer is likely to be needed on the path, it is a nuisance to have to shear or lift back masses flowers each time the path is weeded.

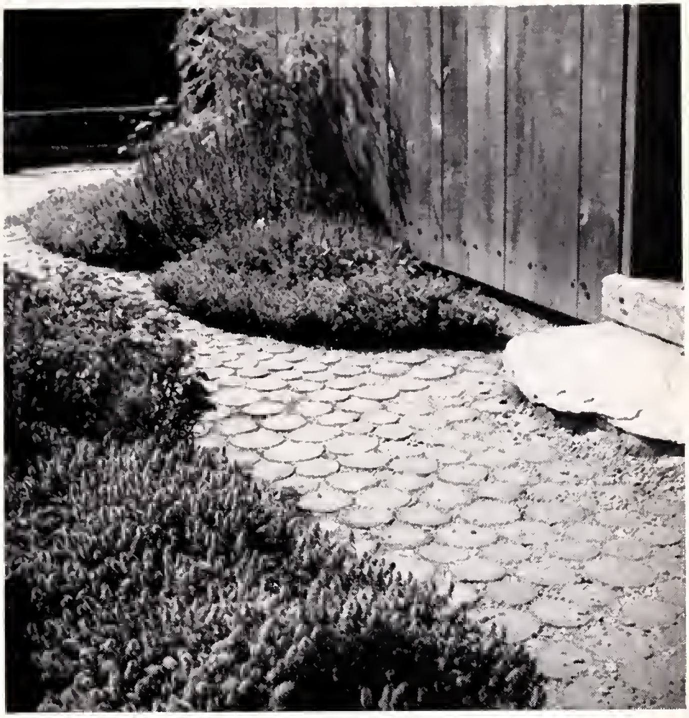
Where a **trimmed hedge** is next to a walk it is important to make sure from the start that the hedge has room to grow to its ultimate width without having either the hedge or the path moved. If the hedge is planted small this may result in a wide expanse of soil for several years; but mulch or ground cover or even a strip of grass (the width of the lawn mower) is much less expensive than major moving later. Tall hedges such as hemlock, beech, hawthorn, and ironwood are correspondingly broad, and should be planted so that their center line is at least 3 feet, or better 4 feet, from the edge of the path. Privet (*Ligustrum*), upright yew (*Taxus cuspidata capitata*), and American arbor-vitae (*Thuja occidentalis*) can be kept in bounds with centers 2½ to 3 feet away. Only low or fairly narrow hedges such as Hatfield or Hicks yew (*Taxus media hatfieldi* or *T. media hicksi*) and Japanese hollies (*Ilex crenata* and *I. crenata convexa*) should be as close as 2 feet; and even dwarf box (*Buxus*) in tiny sizes will encroach in seven or eight years, if it is closer than one foot to the edge of the path.

Occasionally a walk is bordered by a **low ground cover** such as English ivy (*Hedera helix*) or trailing-myrtle (*Vinca minor*). The front line of the ground cover should be at least 8 inches back from the paving, if constant clipping or trampling is to be avoided even by the end of the first or second season after planting.

Particular care must be taken to avoid **thorny plants** too close to walks. In the rose beds the edge row should be at least

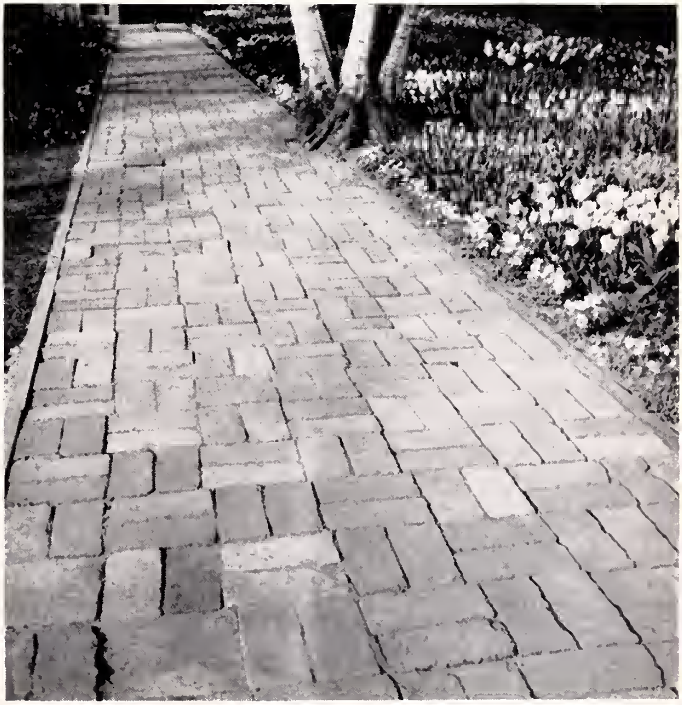
Detail of brick walk, shown here with a crown in the middle. Where surface drainage is good, the crown will not be needed.





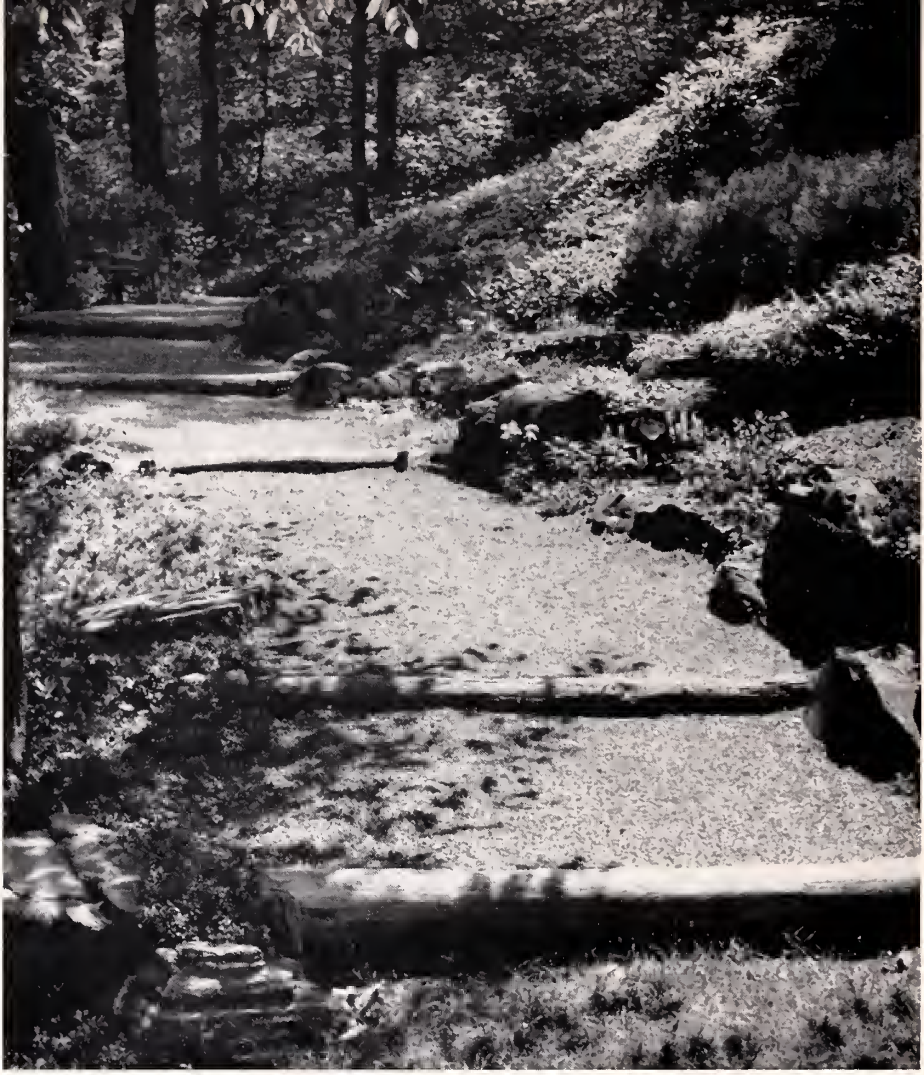
In this Colonial garden, herbs border a path paved with rounds cut from the trunks of cedar or other woods. Treating with a phenol wood preservative is essential to lengthen the life of the paving.

George Taloumis photo



Old brick, set in a simple pattern over a base of sand, results in a pleasing garden path. A line of brick is used as an edging.

T. H. Everett photo

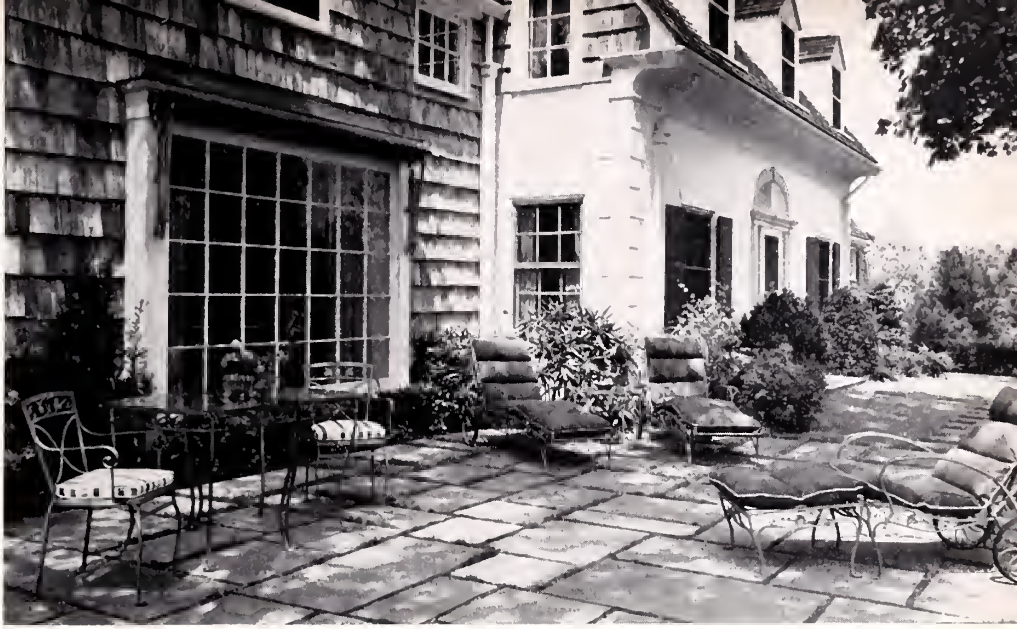


Roche photo

Locust logs, solidly anchored at the ends with rods or heavy wooden pins driven into the ground, are a good choice as steps for this woodland path. The path may be surfaced with wood chips, tanbark, neutral colored crushed stone or fine gravel.

a foot from the path and farther than that if they are vigorous roses. Wintergreen barberry (*Berberis julianae*) makes a beautiful evergreen hedge, and Japanese barberry (*Berberis thunbergi*), an inexpensive deciduous one. They are most disastrous at too close quarters, however, and should be kept with centers at least 2 feet from the edge of the walk.

The same caution in spacing must be observed with **untrimmed hedges** of plants such as lilacs (*Syringa*), flowering quince (*Chaenomeles*), and Father Hugo's or rugosa roses (*Rosa hugonis* and *R. rugosa*). These must be set 3 to 4 feet from the path edge if they are not to end by being trimmed hedges on the side toward the path.



Gottscho-Schleisner photo

A terrace of well-proportioned random rectangular flagstones. Wide joints (with grass) require more maintenance time than narrow (unplanted) joints.

PAVED TERRACES

Garden space for open-air living

ALMOST every property today, whether large or small, includes one or more areas designed for comfortable outdoor living through many months of the year.

Choice of Material

Grass is suitable for terraces which receive little rough use, but these "outdoor living rooms" must usually be surfaced with some other material, both for ease of upkeep and for comfort. Paving may be flagstone, native stone, brick, concrete, wood, or gravel. The choice of material depends largely on the location of the area (that is, whether it is immediately adjacent to the house, in the garden, or in a secluded corner of a wooded property), on the availability of local materials, and on the particular use to which the area is to be put.

Flagstone or concrete paving is usually the most formal in appearance and is particularly suitable immediately adjoining a house, where the feeling of the terrace is architectural or where the surface will get very hard wear.

Brick of pleasing texture and color is equally good near the house and is, when weathered, a little more subtle in color and more attractive for informal or traditional houses. It is well adapted also for terraces in the garden or under big trees, where the mellow shadings of weathered brick are less conspicuous than the colder gray of stone.

In parts of the country where the climate permits, **sections of log** form most interesting patterns and are particularly fine for informal gardens or for the wilder areas of the place. They are usually less permanent than stone, concrete, or brick, but also less expensive to install.

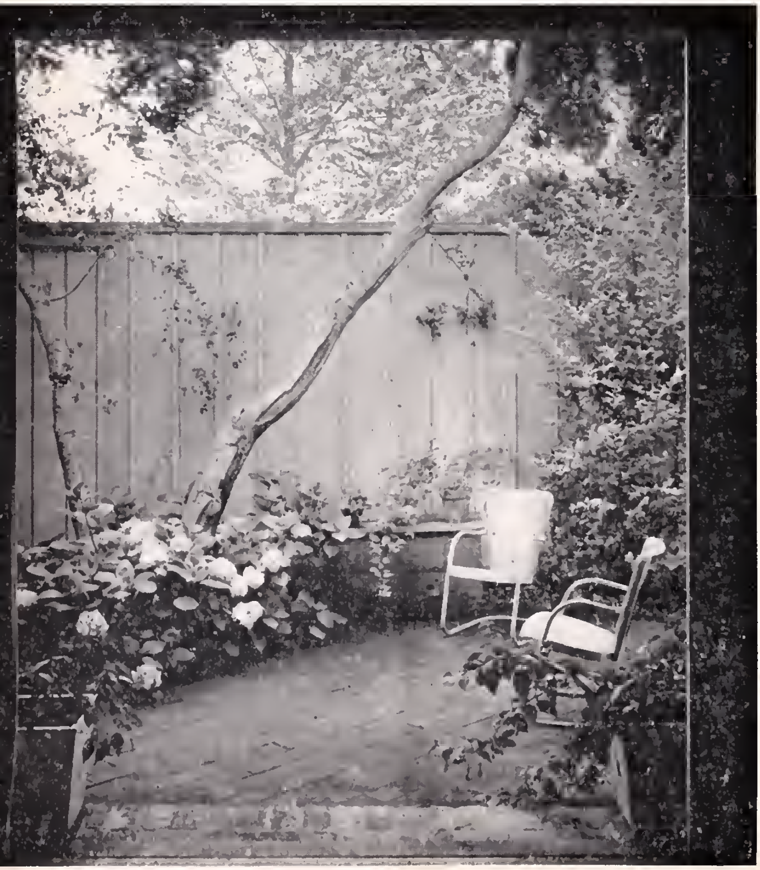
Where expense is definitely a factor, paved areas of **gravel**, if properly built, are satisfactory. They are not practical where heavy furniture is to be placed, as it almost inevitably digs into the gravel surface; and they are not well chosen for safety where small children are to play.

The **expense of installation** depends on the locality and the labor. In one section of the country brick may be cheap and flagstone very expensive. In another, they may be almost exactly the same price. The labor of laying the terrace with proper foundation is a large part of the cost, and if the owner can do it himself, the paving is likely to cost one-third to one-half less than a contractor's price.

Planting

Plant material near living terraces must be chosen with great care. Since there is likely to be constant use of the outdoor room, plants must be chosen for special attractiveness and presentability at the seasons when the terrace is used, and for their faculty of staying in bounds without encroachment on the terrace itself. Terraces that adjoin the house must, of course, have their planting in keeping with the architecture of the house itself and should usually have very few plants, but interesting ones that look well at close range.

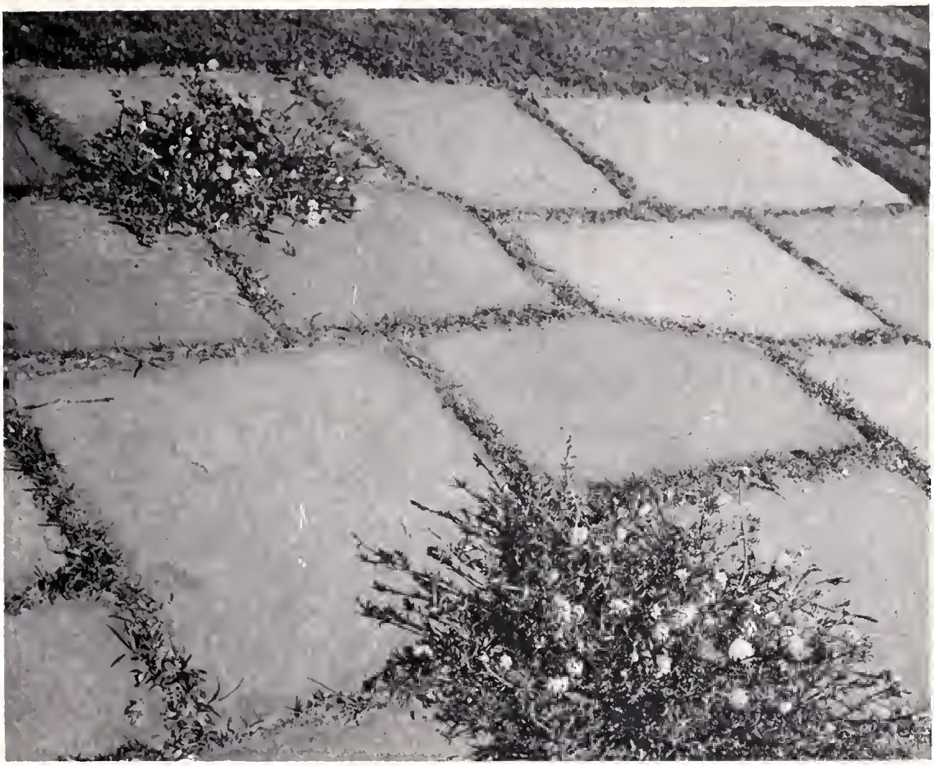
Where the terraces adjoin lawns, there must always be a very carefully aligned firm edge so that hand clipping is not necessary along the edge of the terrace. This is particularly important with gravel or wood-block terraces in order to maintain tidiness and permanent form.



The paving of wood blocks on the floor of this outdoor sitting area blends well with the tall screen fence of wide boards.

L.A. Thomas D. Church

Baer photo



Gottscho-Schleisner photo

This detail of flagstone laid directly on earth shows grass and tufts of perennials growing in wide joints. In many situations, narrow joints are preferable.

As a general rule, it is wise to have as little plant growth as possible in the paved surface itself. Pads of grass in the joints of stone or brick require constant clipping and are dangerous to furniture and to ankles. Too many creeping plants underfoot make family and guests feel uneasy about moving freely in the area for fear of stepping on the plants. There are a few very low ground-cover plants suitable for terraces of native stone (which inevitably have rather wide joints) or of wood blocks. Creeping thyme (*Thymus serpyllum*), creeping speedwell (*Veronica repens*), and ground-ivy (*Nepeta hederacea*) will stand a considerable amount of trampling without complete destruction of the plants. All of them must, however, be used with discretion if the terrace is to be at all comfortable for constant use.

Construction Specifications

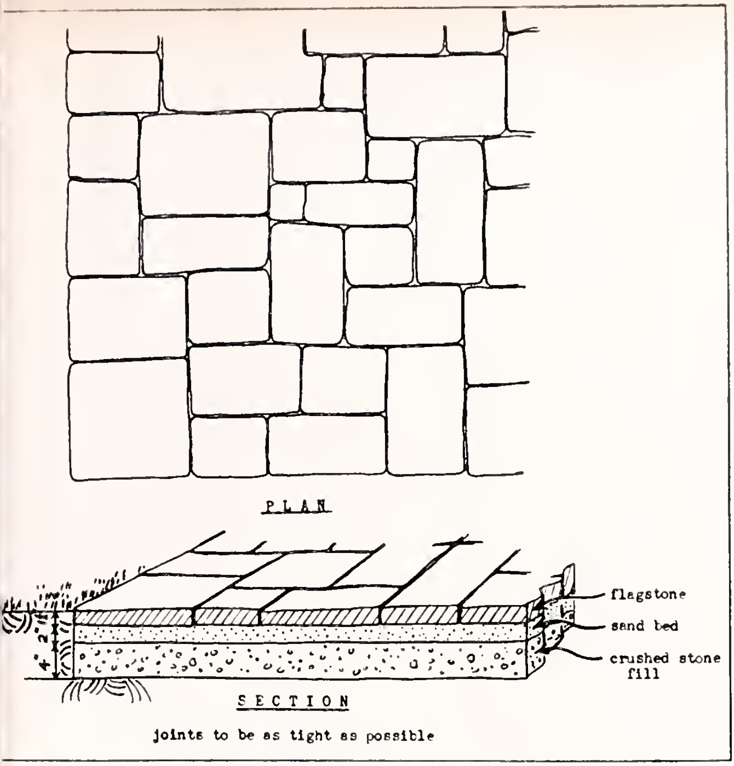
Flagstone paving. Flagstone should be random rectangular pieces in sizes varying from 1 foot in smallest dimension to 3 or 4 feet in largest dimension. Irregular or broken pieces look restless and are much harder to lay. The thickness must be uniform but may vary from ¾ inch in very mild climates to 3 inches in very severe ones. Flagstone 1½ inches thick is usually most readily available and satisfactory.

In sandy soil or in climates where there is no frost the stones may be laid without foundations. The area should be excavated to the depth of the stone and leveled carefully. Any soft spots should be removed and the whole surface made smooth and uniform. Stones are then laid as described later. In heavy soil and for more permanently level surface

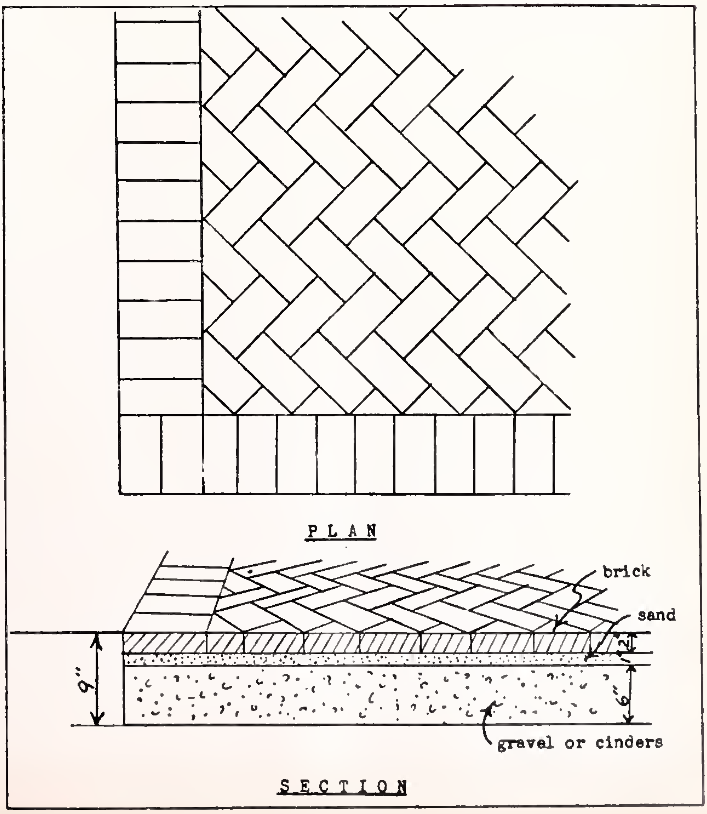
The beauty of this attractive brick and flagstone terrace is accentuated by the old specimen of mountain-laurel pruned as a small flowering tree.

The outdoor living space of homes built on steeply sloping land can be extended by constructing wooden decks. Wide benches edge this one.

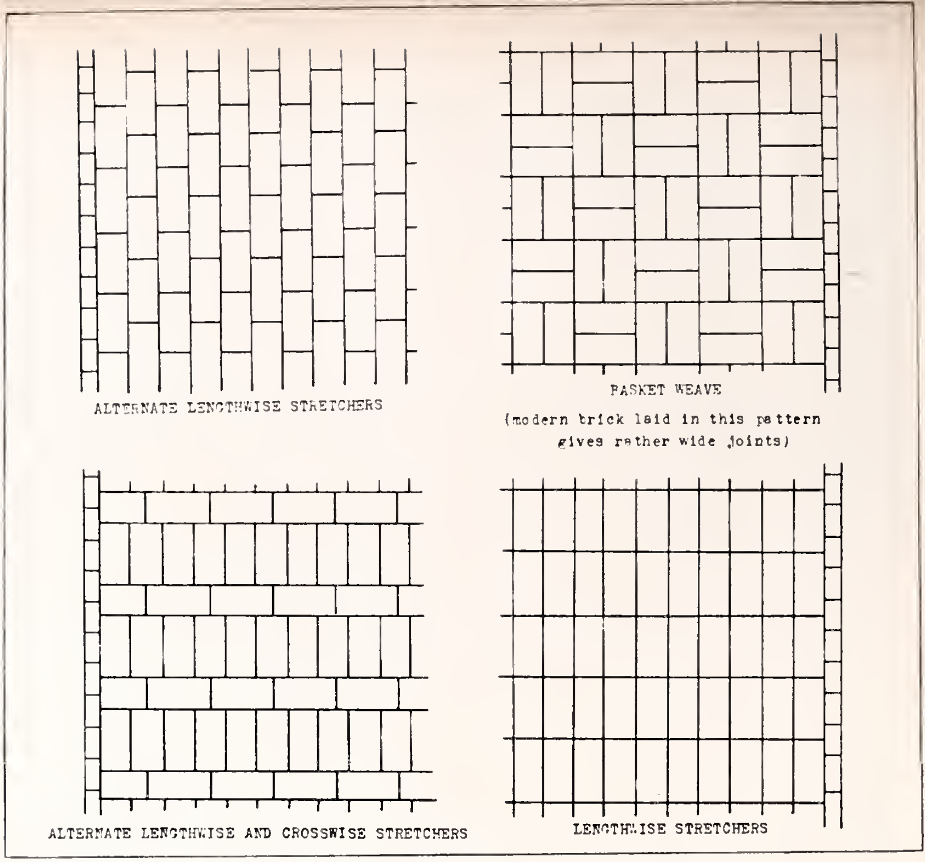
L.A. Thomas D. Church *Maynard L. Parker photo*



Detail of random rectangular flagstone laid dry.



Detail of brick paving.


ALTERNATE LENGTHWISE STRETCHERS
BASKET WEAVE
(modern brick laid in this pattern gives rather wide joints)
ALTERNATE LENGTHWISE AND CROSSWISE STRETCHERS
LENGTHWISE STRETCHERS

Various brick walk and pavement patterns.

in most climates a foundation of cinders and sand is advisable. A concrete base may be used but adds greatly to the expense and is not necessary.

The area is excavated to allow for 8 inches of foundation under the stone, *i.e.,* total depth of excavation for average 1½-inch stone is 9 to 10 inches. The subgrade must be tamped smooth and uniform, with a slight pitch—not more than 3 inches in 10 feet in any direction. On this subgrade place clean coarse boiler cinders or gravel, whichever is cheaper locally, flood with water and tamp or roll so it is about 6 inches deep and uniform. On this layer place enough clean sand to make approximately a 2-inch layer, after tamping and leveling to a firm surface. This should bring the surface of the sand to about 1½ inches below the grade.

On this foundation the flagstones should be laid as tightly together as possible, with no wide joints. This prevents weeds and grass from coming up between the stones and gives a firm safe surface. After the stones are laid sand must be swept into all the joints and washed in, and this process repeated several times a week for a week or two to prevent the stones from shifting. The paving should have the same slight pitch of 2 to 3 inches in 10 feet that was established in the subgrade, to provide drainage.

Brick paving. The topsoil on the area to be paved is stripped off and piled in a convenient place for later use. The area is then excavated to a depth of 9 inches below finished grade. This subgrade is thoroughly tamped smooth and uniform.

L.A. Alice Recknagel Ireys *Buhle photo*

Common brick laid on sand and cinders in herringbone pattern blends well with the foliage nearby.

Upon this subgrade a layer of clean boiler cinders or coarse gravel is spread about 6 to 7 inches deep. It is flooded with water and thoroughly tamped so that when completed it is 6 inches in depth.

On this foundation is placed a layer of fine sand, 1 inch in thickness. It must be carefully graded, wet, and tamped to make a good level surface for laying the bricks.

Bricks must be the type called selected common, hard-burned, and must be chosen for pleasant color and texture. Second-hand bricks when available are usually softer in color, but should be free of cement. The bricks are laid as close together as possible, with no joints, to give an even walking surface. After the bricks are properly laid, sand is spread over the surface of the paving and brushed into the joints to prevent any movement of the bricks.

Gravel paving depends for its success on painstaking construction, as careful as for a tennis court. The area is excavated to a depth of 6 inches and any soft material removed and replaced with suitably hard filler. The subgrade must then be rolled smooth and uniform.

On this subgrade lay a bed of clean hard, broken stone, coarse gravel, or clean, coarse boiler cinders, whichever is cheaper locally. This should be deposited in two layers, each layer watered, rolled, and tamped till thoroughly compacted. This course, when completed, should be 2 inches below finished grade.

On this foundation spread gravel, varying in size from grits up to ½ inch in largest dimension, with enough clay in it so that it will pack firmly. It should be deposited in ½-inch layers, each layer watered, tamped, and rolled until thoroughly compacted. A very thin layer, not more than ½ inch, of local grits (fine gravel) may be spread over the top and rolled in thoroughly.

The edges should be defined by a row of sound hard common bricks laid on the 2- x 4-inch face, flush with the adjoining turf, if grass adjoins the paving, an inch above the soil if planting is next to the paving.

Concrete paving should be 4 inches thick, and in heavy soils or where drainage is poor should have a foundation of 6 inches of cinders or coarse gravel. The base, whether of soil or of drainage material, must be carefully leveled and tamped firm. As concrete by itself is likely to be a little monotonous and cold, combining it with materials of other colors and textures makes a more interesting terrace. Brick, stone, or wood may be worked into the paving to form an edge or to give pattern to the entire area. These materials should be put in place before the concrete is poured, and can be used as forms for the work. If the terrace is to be entirely of concrete, a temporary form of wood, usually 1- x 4-inch boards, must be pegged firmly along the edges and other boards used to form expansion joints during the progress of the work. Spacing of the boards can vary but in general they should not be more than 3 feet apart.

Concrete should consist of one part cement, two parts sand, and three parts gravel. It should be poured in sections formed by either the permanent or the temporary dividers, and leveled off with a straight piece of board worked back and forth across the dividers. It is imperative to have the dividers perfectly level and in alignment if the terrace is to be of correct grade. The best-looking finish is usually obtained by letting the concrete stand for four to eight hours, and then scrubbing with a stiff brush and cold water. This takes away the over-smooth look associated with city sidewalks, and brings variation in color from the kind of sand and gravel used. Further interesting color effects can be obtained, and the glare from too white paving avoided by adding color to the concrete, or using a colored crushed stone or brick for part or all of the gravel in the mixture. Great care should be used and a considerable amount of experimenting done, however, as it is easy to overdo color and get a garish terrace.

Concrete should be covered with wet burlap or straw as soon as it is hard enough on the surface to avoid sticking to the cover, and kept moist by frequent gentle sprinkling of the cover for a week or two. This is particularly important in hot sunny places. Concrete should never be poured when there is danger of hard freezing during the time it is hardening.

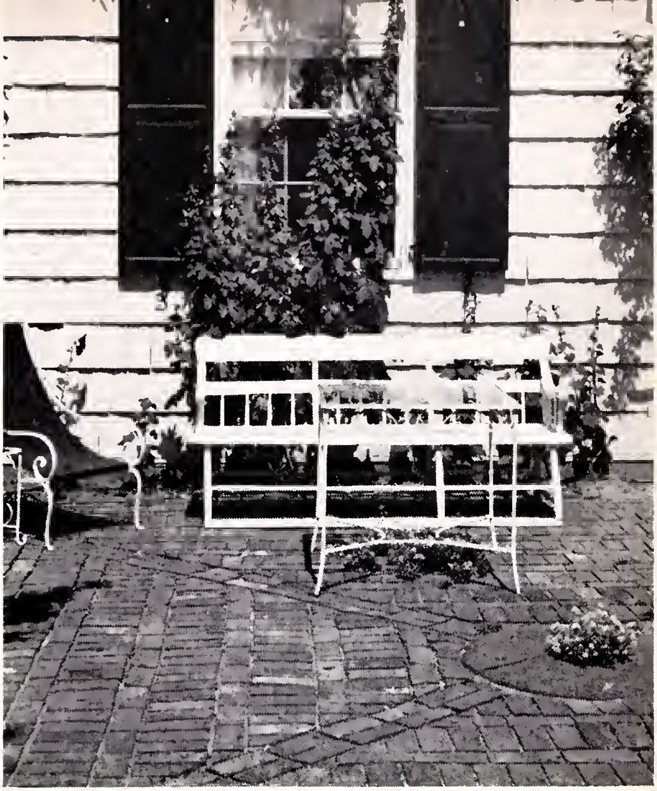
Wood paving may be either of rectangular blocks or of round sections cut from logs. It is perhaps most useful in mild climates, as the blocks are inclined to

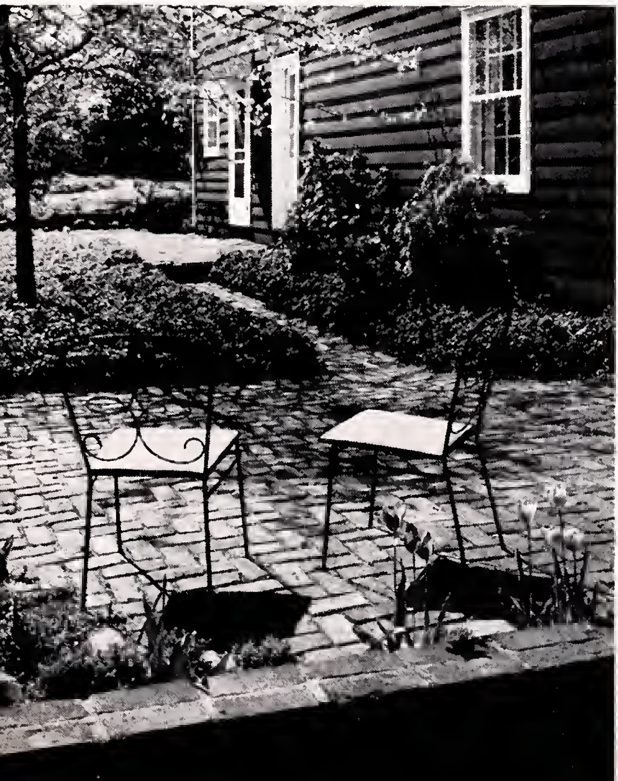
A smooth light surface of concrete is easily maintained but likely to cause glare unless under overhead shade.

McFarland photo

The pattern of this brick-paved terrace radiates from an old mill wheel laid in the center. Brick paving is in character with terrace furnishings and the shingled house.

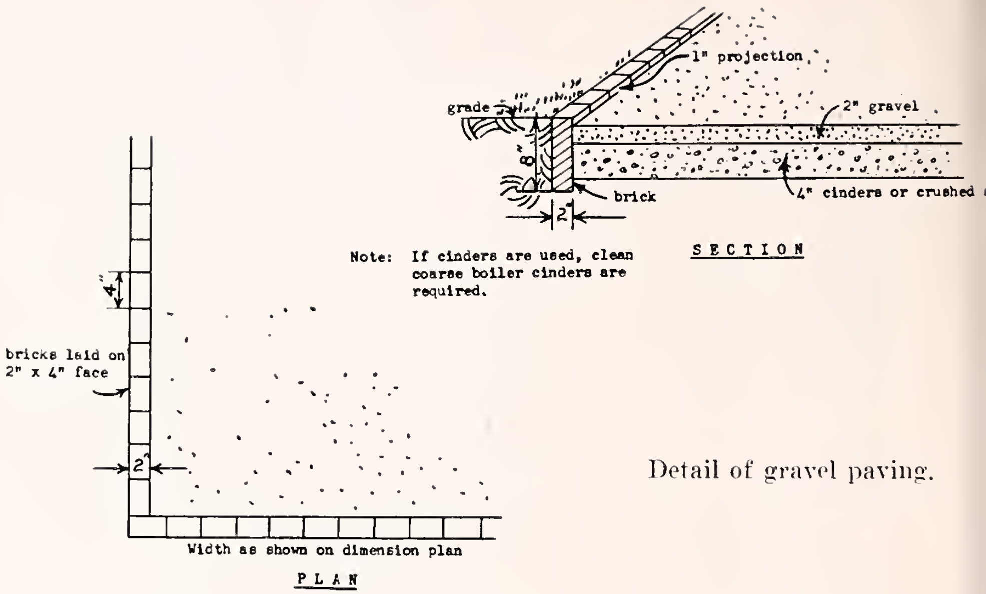
Gottscho-Schleisner photo





There is harmony in the textures of the pachysandra ground cover and the paving of mellow bricks.

Roche photo


1" projection
grade
2" gravel
8"
brick
4" cinders or crushed
2"
Note: If cinders are used, clean coarse boiler cinders are required.
SECTION
4"
bricks laid on 2" x 4" face
2"
Width as shown on dimension plan
PLAN

Detail of gravel paving.

heave out of position very badly in winter and to disintegrate in extremes of temperature. The rectangular blocks can be bought commercially in many localities and are usually creosoted for preservation. The round sections cut from logs can also be purchased in areas where there is a considerable lumbering industry or they can be cut by a local sawmill, or even by an industrious amateur. They should be of some rot-resistant wood—locust, cypress, white cedar, or redwood — and should be thoroughly treated with copper napthenate or pentachlorophenol* solution, according to manufacturers' directions.

In mild climates or in light soil, they can be laid directly on the earth. In heavier soil or where winter heaving is a problem, a foundation of 6 inches of broken stone and 2 inches of sand is advisable. As wood paving has a tendency to slip away from its original position, it is advisable to have a solid edge to keep it firm. The border may be of native stone set on edge, or of planks or logs treated with preservative, set deeply into the earth, and pegged in place.

For **tanbark or pine-needle paving** the area to be paved is dug out for a depth of 2 inches, the subgrade tamped or rolled smooth and uniform and covered with tanbark or pine needles.

The edge of the paving may consist of either sound hard-burned common bricks laid on their 2- x 4-inch faces, projecting ½ inch above the finished paving; or ½- x 4-inch creosoted boards, pegged into place at 4-foot intervals before the tanbark or pine needles are laid, and projecting 1 inch above the finished surface.

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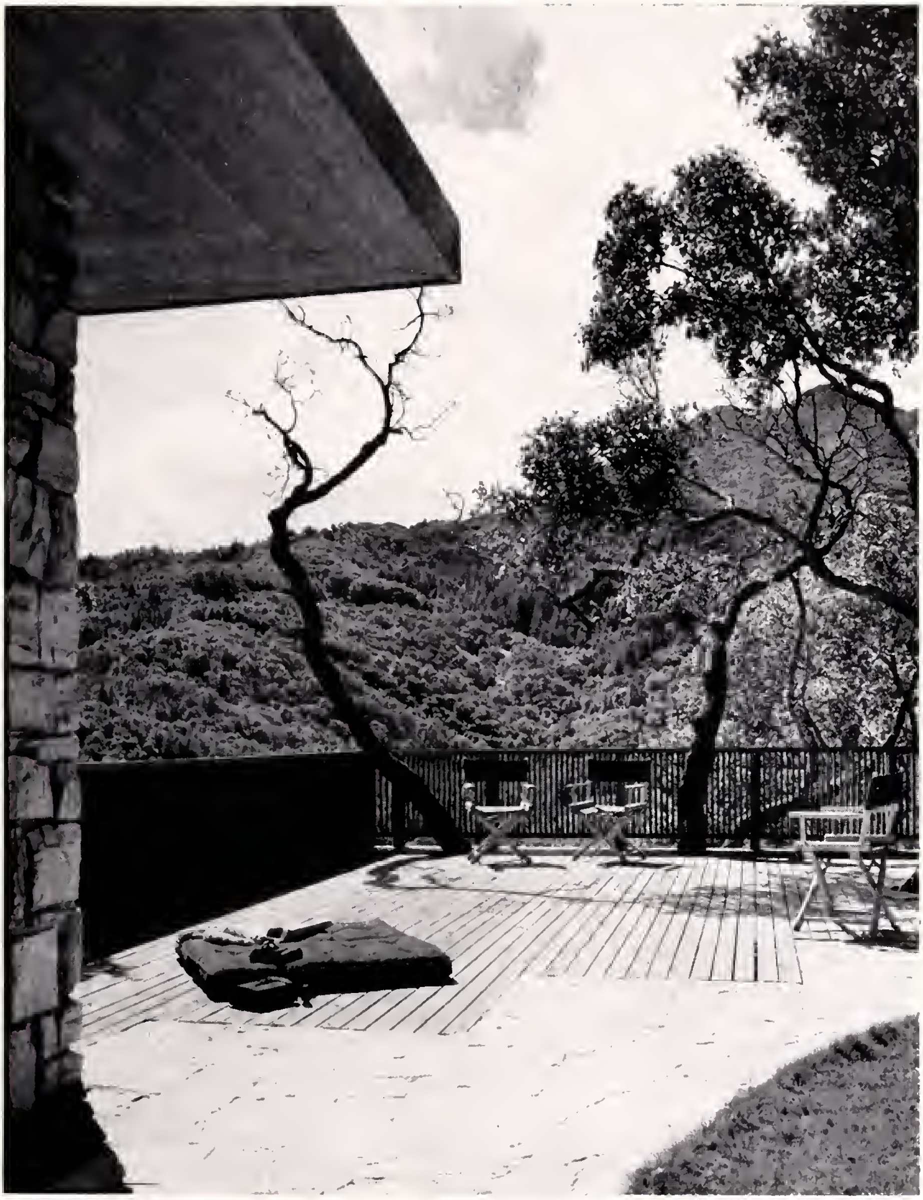
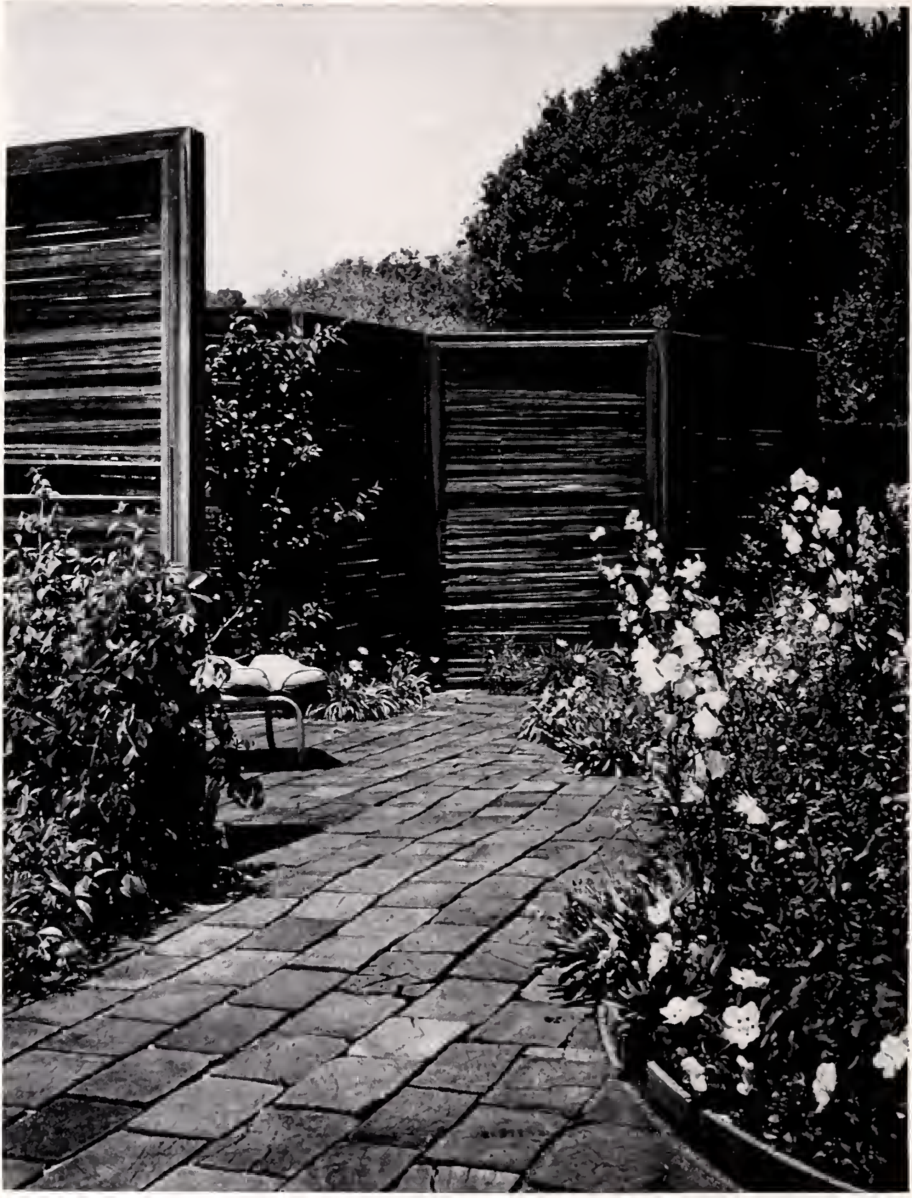
* Obtainable under such trade names as Dowicide 7, Woodlife, Wood-treat, Cuprinol, and Naptox. Since these compounds may caue irritation of the skin, manufacturers' precautions should be clearly observed.



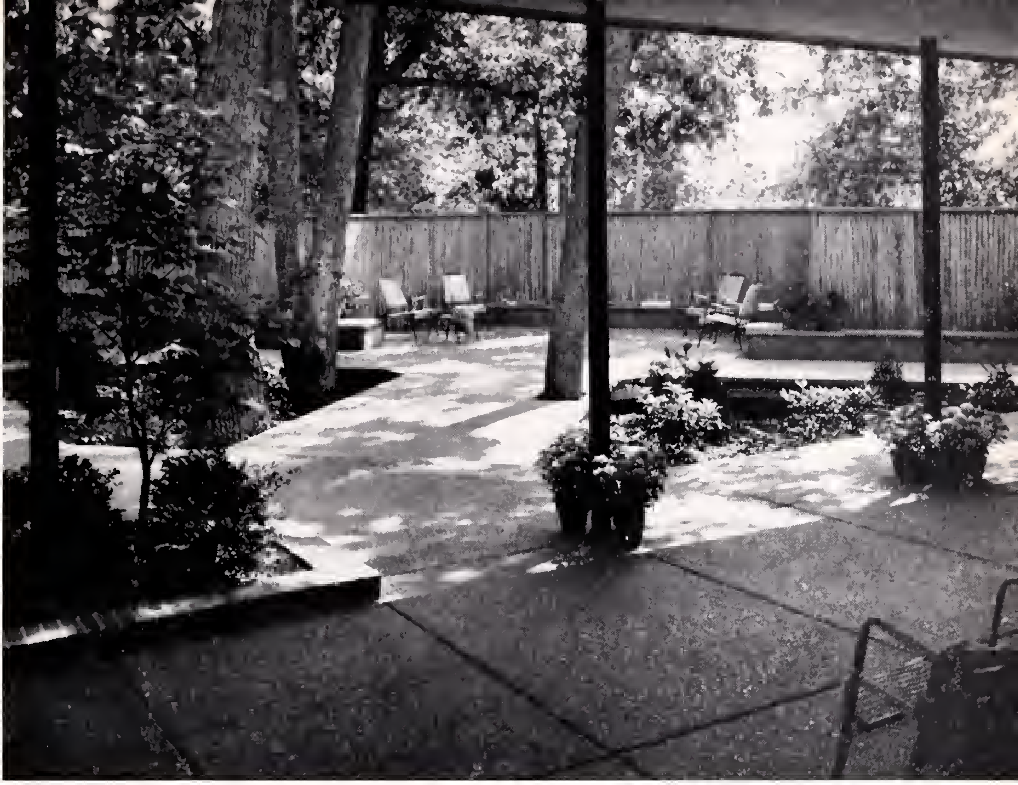
L.A. Eckbo, Royston & Williams *Baer photo*

This terrace, with a combination of boards and stone laid in mortar, has dramatic contrast and is ideally suited to its surroundings.



L.A. Thomas D. Church *Baer photo*

Wood paving blocks with a wood curb to hold them firmly in place make this a practical terrace. The interesting screen fence in the background combines well with the wood textures and coloring in the paving.



L.A. Thomas D. Church *Emelie Danielson Nicholson photo*

Extensive overhead shelter and raised floor make this outdoor living area useable at most any time, regardless of weather. Neatly designed fence gives complete privacy.

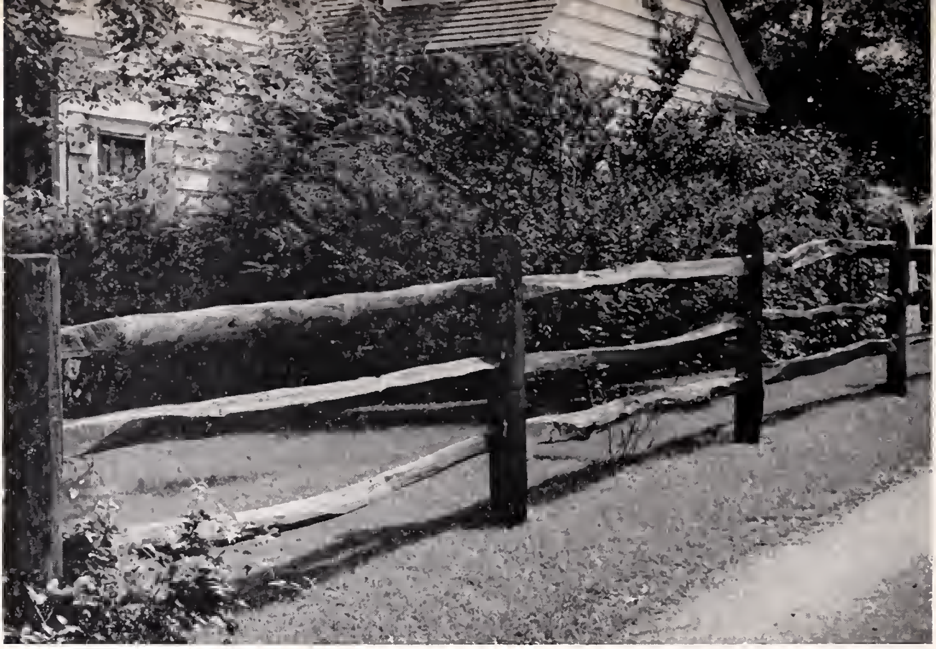
FENCES

For function and beauty

FENCES have almost infinite possibilities and variations in design, material, and usefulness. They serve almost the same purposes as free-standing walls or hedges and are usually about halfway between the two in price.

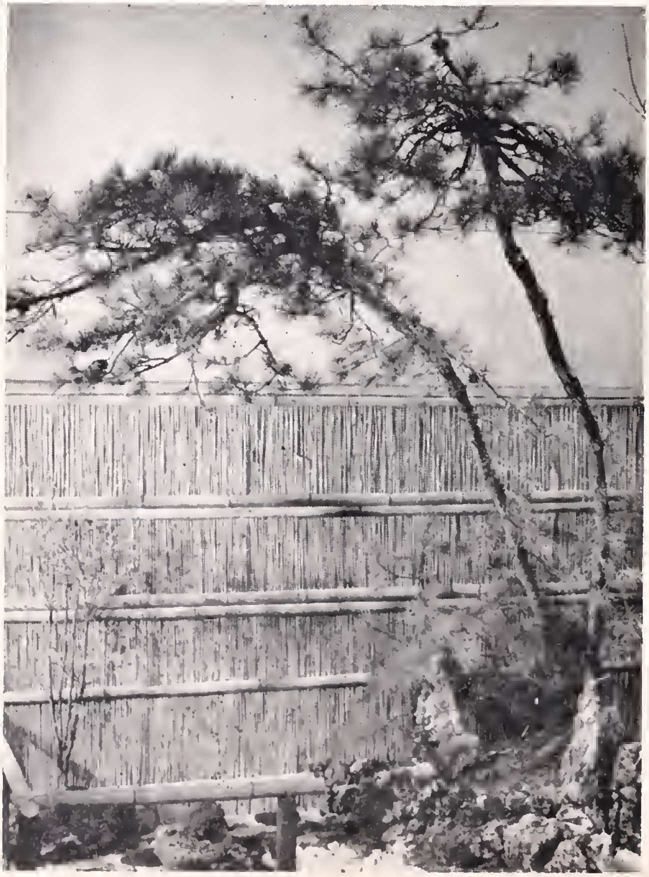
The reason for building the fence is a primary factor in determining the type of material and general design. It may be wanted essentially for a screen, seclusion, or windbreak. In that case, it is usually high and tight. At the other extreme is the fence primarily designed to serve as a boundary or as a support for some kind of vine. This type is usually of low or medium height and of open character. Other fences may be used as decorative adjuncts to a garden or to separate the cultivated part of the place from the wild or from the service areas.

The architecture of the house is also important in deciding on the architecture of the fence, and the immediate surroundings of the place itself and its neighbors should play some part in the decision.



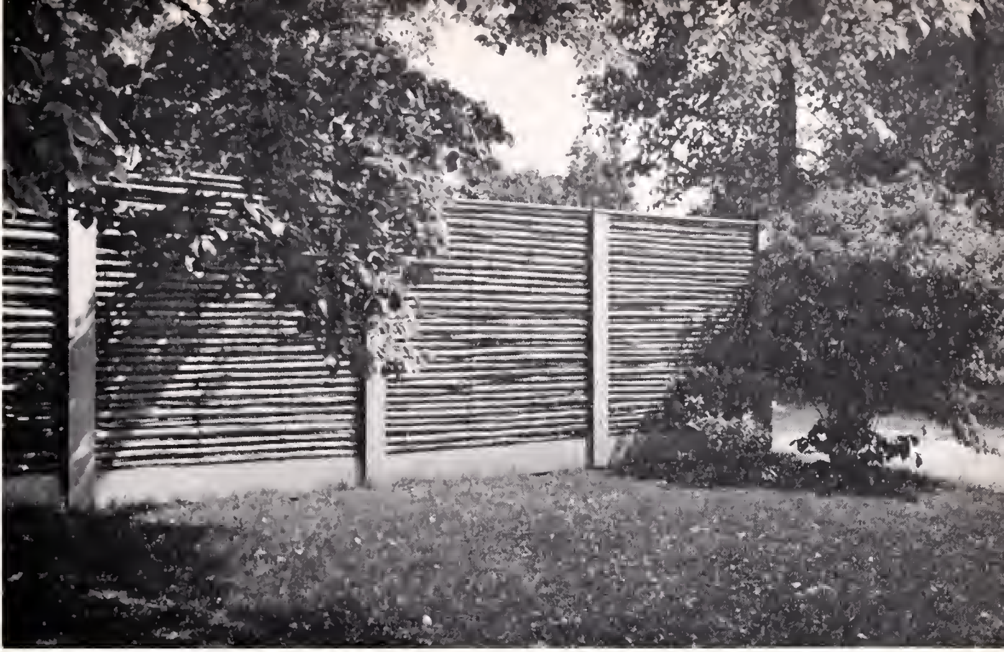
Roche photo

Post-and-rail fence is readily erected and a good boundary in rather open country.



An interesting pattern has been created in this fence by running heavy bamboo tonkins horizontally across the fine vertical canes.

L. A. Ethelbert Furlong *Roche photo*

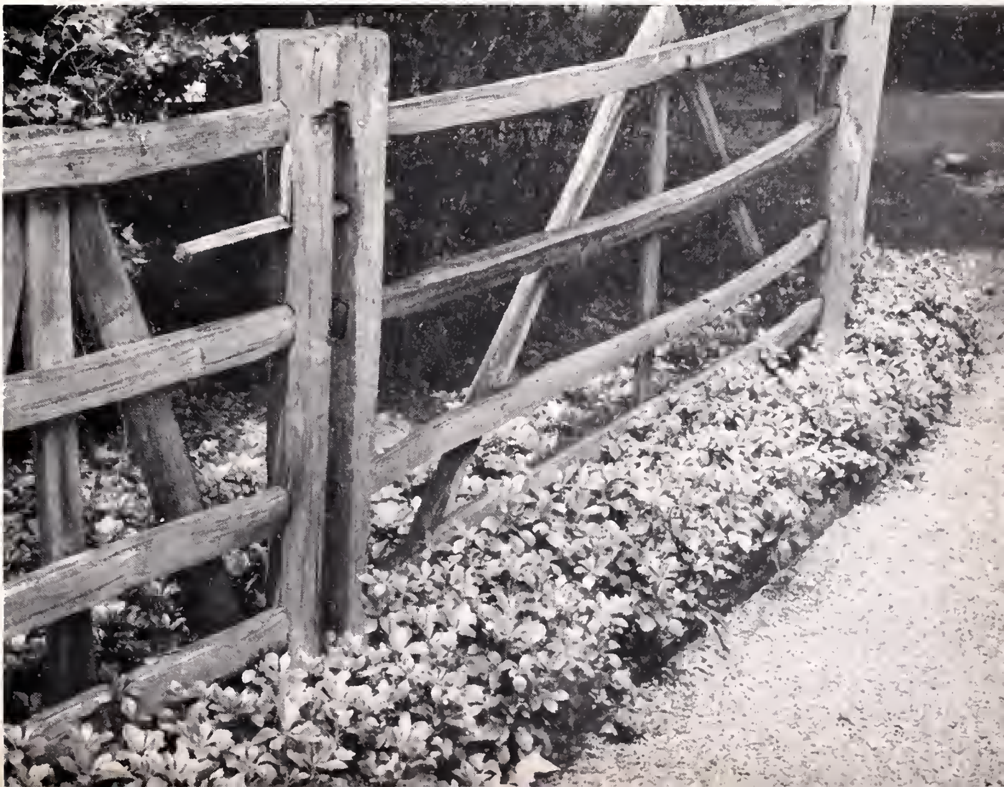


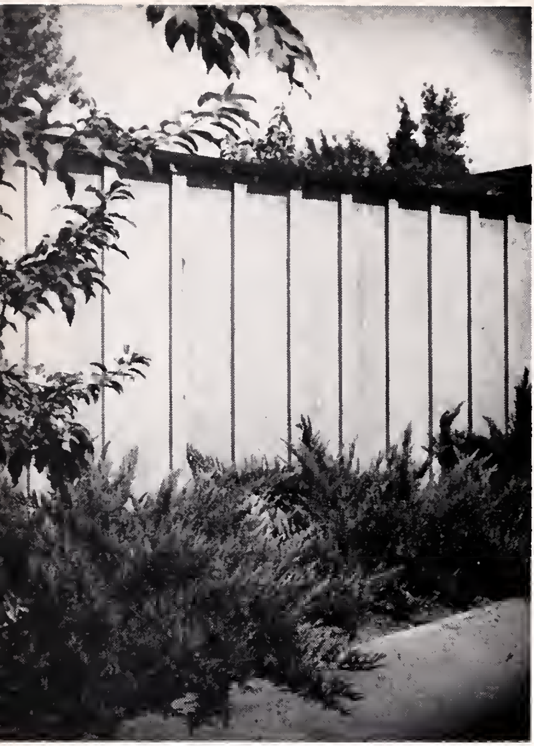
L. A. Mary Deputy Cattell

Woven sapling fencing takes on a new feeling when the lines run horizontally instead of the conventional upright position, with each section of fencing supported by heavy boards.

Hurdle type fencing in natural wood tones serves well to mark street-front and drive boundaries. Curbing in front of the fence keeps gravel on drive and out of the pachysandra planting.

Gottscho-Schleisner photos





L.A. Thomas D. Church

The design of a solid wood fence, often a necessity for complete privacy, can be greatly improved with added wood trim on the sides and top.

Kinds of Fences

The **materials** of the fence may vary from crudely split rails or saplings to the most sophisticated modern plastic or plywood sheet, with infinite variations between them.

Boundary-line fences of post and rail or of hurdle-fencing come ready-made and are relatively easy for the owner to erect with a little common-labor help. Since they originated in the country, where wood was plentiful and available, they usually look better in the same sort of setting. They seem appropriate to the farm or the place in open country or around the property of 3 to 4 acres in extent.

In the smaller suburban property the **board version of the post and rail** is usually more at home. It may consist of two or three horizontal boards nailed between posts; and its decorative value depends greatly on finials used on top of the posts and on the proportions of the boards. If it consists of three horizontal boards, graduating them—using 1- x 4-inch board for the top, 1 x 5 for the second, and 1 x 6 for the bottom—results in a more interesting design. A very attractive variation, common to many parts of the country, is that of a horizontal board at top and bottom with cross boards between. This is a very simple, easy fence to erect and a little more decorative than the plain horizontal boards. Board fences of any sort may be left unpainted and allowed to weather to a soft gray, or painted a color appropriate to the surroundings. If vines are to be grown on them, it is usually much wiser to leave them unpainted, as removing tangled vines for the painting every three or four years gets to be a major maintenance problem.

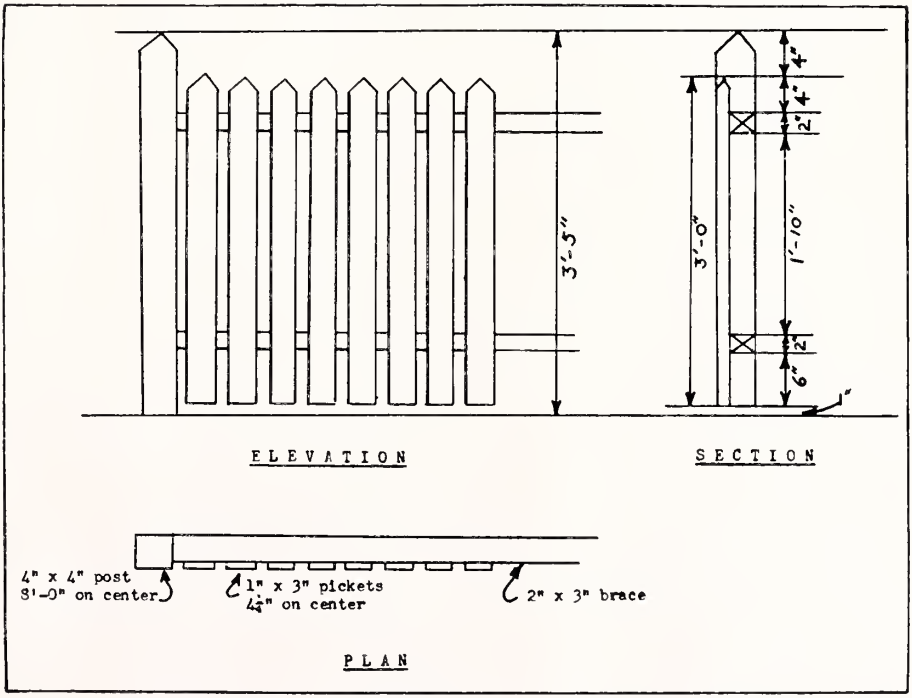
Where the fence must keep out intruding animal life or small children **combination of wire and board** may be necessary. The fence may consist of either iron or wood posts with heavy link wire stretched between them, or may have heavy wire tacked on the back of a board fence and extending down into the ground. Woodchucks, rabbits, dogs, and cats have a way of burrowing under a fence, even if it is only an inch or two from the ground. Small children find fences irresistible to climb if the boards are spaced so that they can get a good toehold.

Fences for screening either part of one's own property or the neighbor's must obviously be tall and tight. The crudest form is the sapling fence, which comes ready to erect and in the right setting is very attractive. It does cut out air, usually; and for the most part it looks better in rather wooded land, where tree branches overhang the top and its more or less rustic character blends with the surroundings. It is

Gottscho-Schleisner photo

A low picket fence of stock pickets gives enclosure from the street and traditional background to a dooryard garden.

Detail of low picket fence.



probably the easiest of all fences to erect. It can be made more architectural in feeling by the addition of boards at the top and bottom or by being set in a panel made of squared wood posts with 2- x 4-inch rails at top and bottom.

Other screen fences may vary from horizontal or vertical wide boards of random widths to sheets of outside plywood or asbestos board, plastic, or combinations of these. The material chosen depends largely on the setting and the cost of the material in the local market. Obviously, the more modern materials do not belong near a traditional house; and the tall, colonial board fence with traditional design would look strange near a contemporary house.

If the object to be screened is very tall, a combination of a solid fence at the bottom and latticework or open mesh of some kind at the top will keep it from looking too forbidding and will let more air through. Where the wind is very strong it is advisable to leave some spacing between the boards or other materials of the fence. Otherwise, there is too much wind resistance and posts are very likely to be loosened in the ground. With a board fence, for example, ¾-inch spacing between the boards will let air through but still give privacy. A louvered fence is the perfect answer to the screen for privacy without cutting out air.

Picket fences are a subject all by themselves. They vary in type, in design, and in use. They are frequently combined with other fences or with walls.

Perhaps the simplest and one of the most attractive is the traditional fence of reasonably narrow flat pickets with pointed tops and the space between the pickets half that of the width of the pickets. In other words, if the picket is 3 inches wide, the space between is 1½ inches. This type of fence is easy to erect and is of stock lumber sizes. Many lumber yards, indeed, carry the pickets already pointed and ready to erect, or even panels of such picket fencing.

Other variations range from very broad board pickets up to 6 inches wide, with tight spacing, to more elaborate and formal round or turned pickets, usually associated with the larger house and more elaborate grounds. This latter type of fence usually is a purely decorative one, marking the boundary or the entrance to the place, and has beautifully turned finials on the fence posts; it is often placed between stone or brick piers.

The lower and more informal flat picket is often useful on top of a low wall or in combination with a horizontal or vertical board fence, for privacy at the bottom of the fence with light and air at the top.

Planting on Fences

Planting on or near fences should be considered carefully. **If the fence is to be painted**, some method of removing any vines grown on the fence must be devised; otherwise there will be an almost endless task every three or four years when it is time to paint the fence. It is probably wiser in that case to use vines that really need severe cutting every two or three years, such as virgin's bower (*Clematis virginiana*) or honeysuckle (*Lonicera*) or akebia (*Akebia quinata*). They make rapid recovery from being cut almost to the ground and actually look better than if allowed to be a tangled mass for years.

With **fences to be left unpainted**, rampant-growing vines are perfectly possible. They are likely, however, to hide the fence completely if left to their own devices and to consist mostly of heavy unbearing wood.

If the fence is well designed and attractive in itself, very little planting near it is needed.

A purely utilitarian **wire fence** is the only one that should be completely covered with vines, as the support of vines is its chief purpose. Fences of open lattice work or thin members of any kind should never have twisting vines like bittersweet (*Celastrus*) or wisteria put on them. In almost no time at all they will be ripped to pieces by the strength of such vigorous growers.

The Brooklyn Botanic Garden's HANDBOOK ON VINES has complete lists of vines for many purposes, and the choice for fences can be made from those lists.

Construction of Fences

The **wood** used for both the fence itself and its posts depends greatly on whether it is to be left to weather or to be painted. In any case, all parts of the wood that touch the ground or at least the parts of the posts that extend below grade should be thoroughly treated with wood preservative before erection. They can be soaked for several days in a solution of either copper naphthenate or pentachlorophenol (see footnote p. 34) and allowed to dry before setting. Another treatment is to give the posts below grade several coats of creosote followed by a coat of tar. If there are a great many posts, either of these treatments entails a great deal of work.

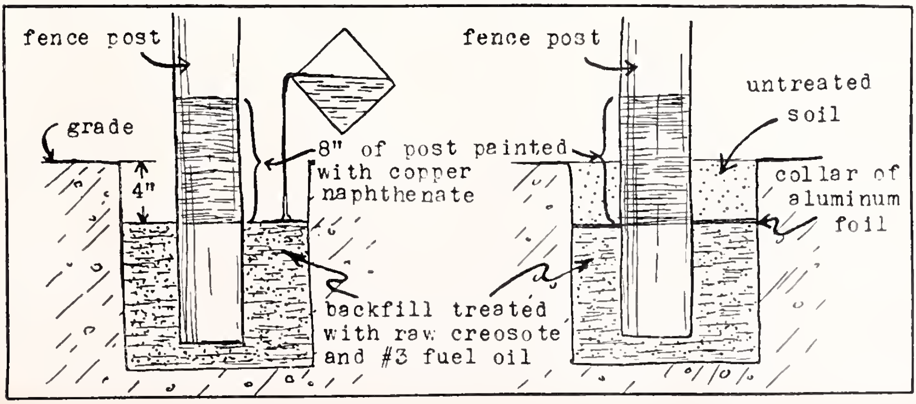
A method of more recent origin, equally satisfactory for the home builder, is to saturate the back fill around the posts after they are in place with a mixture of equal parts of raw creosote and fuel oil No. 3. This should be poured in through the back fill to 4 inches below grade. If planting is to be done near the posts, there should be an aluminum collar over the oil. This can be of heavy aluminum foil but sheet metal is better. From 4 inches below grade to 4 inches above grade, the posts should be painted with 8% copper naphthenate solution. This treatment prevents all forms of rot and is relatively easy to apply.

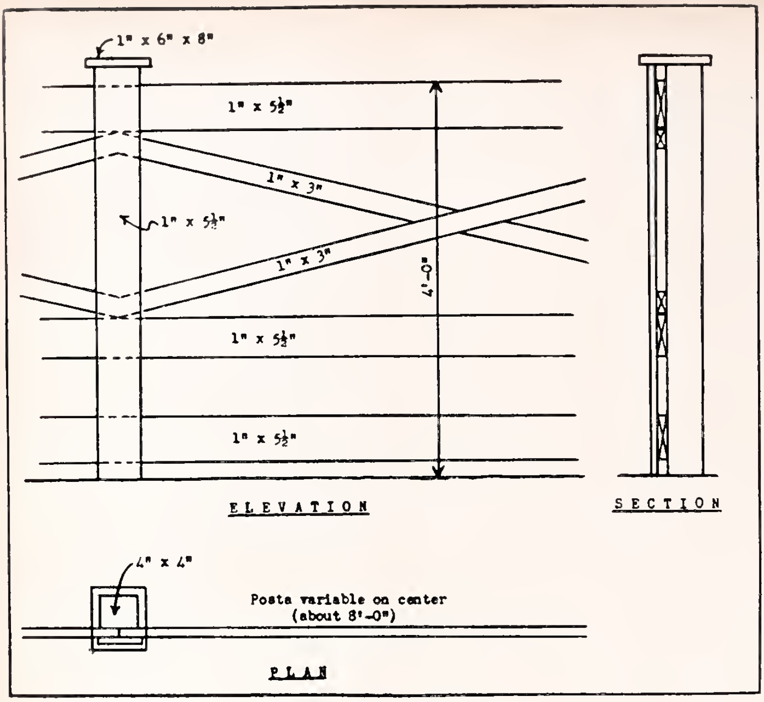
Locust is probably the most durable wood for posts and will actually last for many years with no treatment below grade. It is, however, hard to obtain in many localities; and it is rather rough, usually, so is not too well suited for formal fences. Other satisfactory woods are white cedar, cypress, and redwood, but all of these need protection in the earth.

If the fence is to be left to weather, white cedar, redwood, chestnut, and cypress are satisfactory and turn a very pleasant grayish color in a year or two. It is advisable, even with these woods, to give a coat of preservative, particularly where they adjoin a post or other pieces of wood.

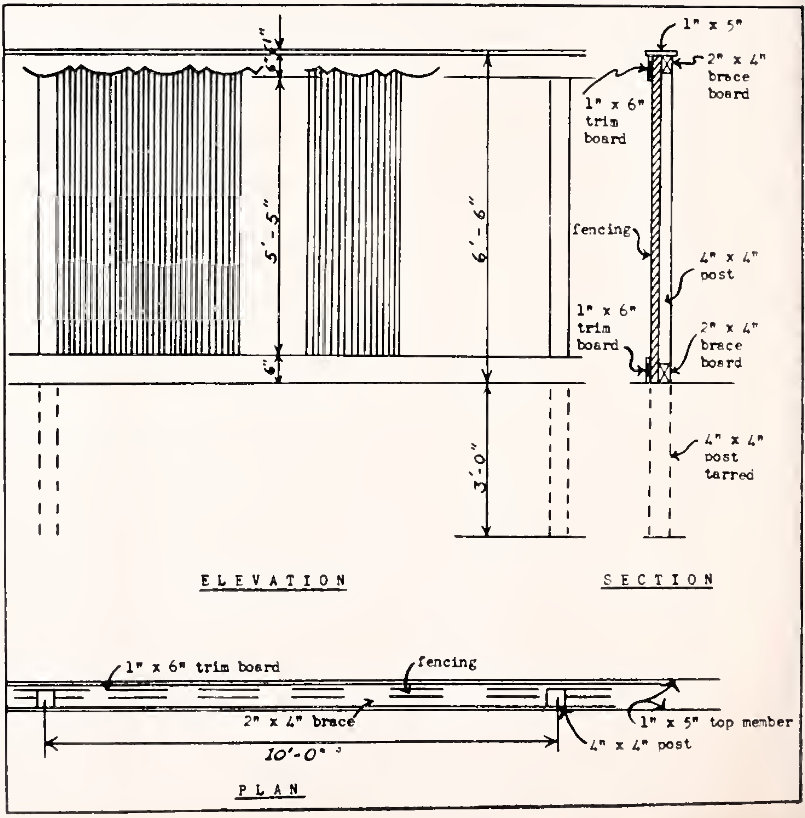
If the fence is to be painted, it may be of almost any wood locally available. Where any two pieces of wood adjoin they should be painted before erection; for example, where the board fence is nailed to the post, the back of the rail and the front of the post should be painted before nailing. Galvanized nails or screws should always be used for erecting fences outdoors so that there will be no trouble with rust on the fence later. Some of the special new materials require special kinds of fastening; but the supplier, whether the manufacturer or the local lumber yard, is usually equipped to give advice and furnish the necessary fasteners for outdoor use.

A method of preserving the underground portion of wood posts.


fence post
grade
4"
8" of post painted with copper naphthenate
backfill treated with raw creosote and #3 fuel oil
fence post
untreated soil
collar of aluminum foil



Detail of board fence.

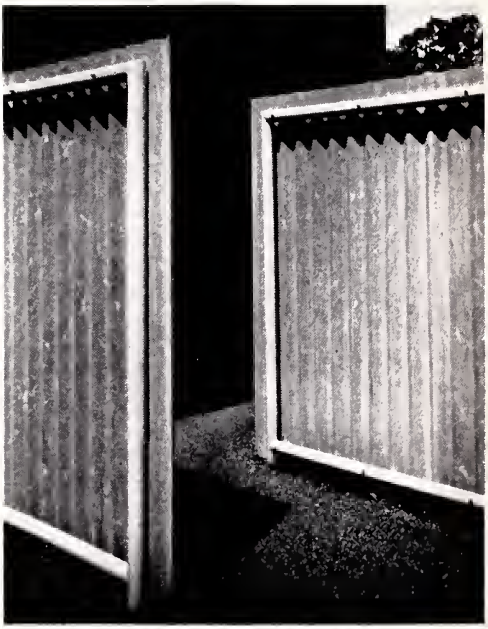


Detail of woven wooden fence with trim board on side.

An open lattice effect at the top of this board fence gives it an unusual appearance.

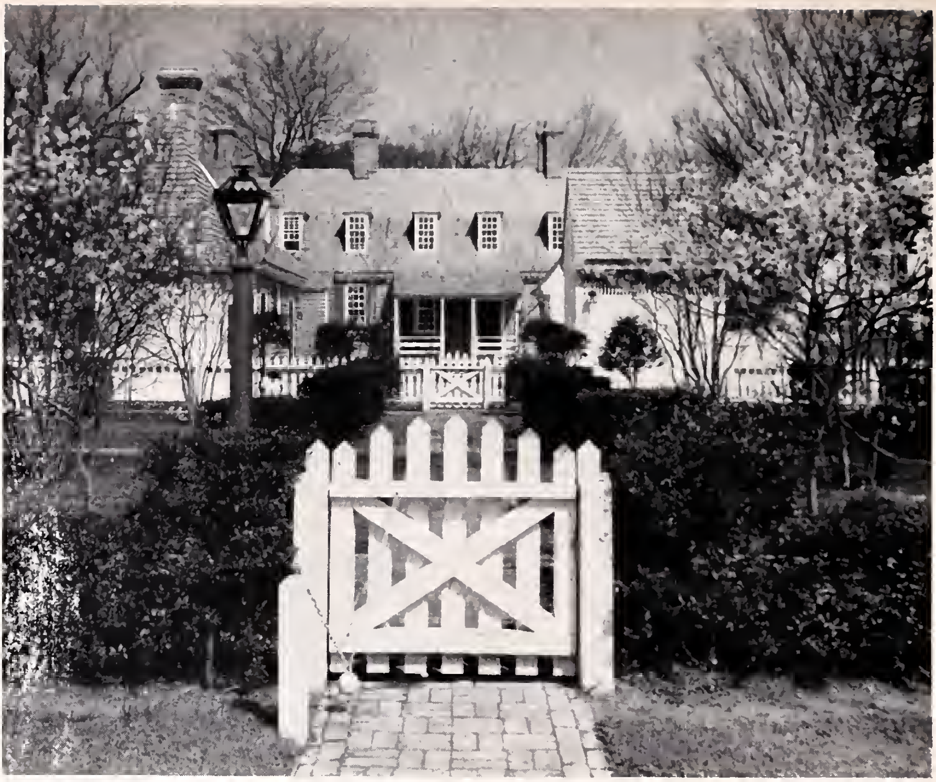
Several types of prefabricated materials are available in sheets which can be bolted to metal frames to form serviceable barrier-type fences.

Maynard L. Parker photo



The heavy supporting beams of this wooden fence are painted a contrasting color. The plant container is of cast concrete.

L.A. Thomas D. Church



Roche photo

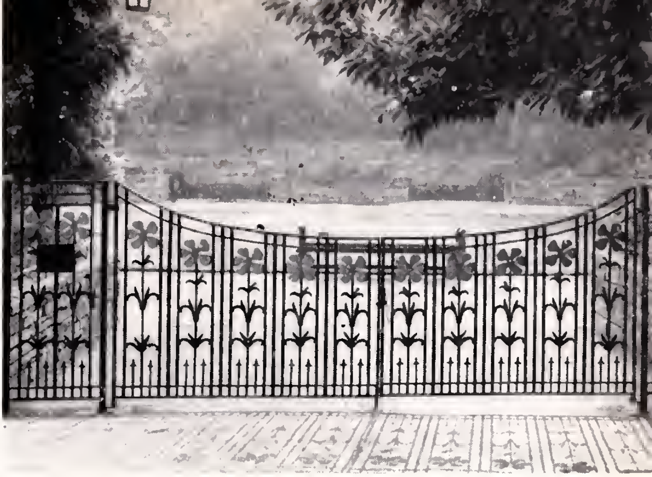
The problem of the always-open gate is solved in Colonial Williamsburg by a chain and heavy iron ball which automatically swings this gate closed.

GATES

GATES may be either for access from one part of the property to another, or into adjoining property, or part of a screen for a service yard, and should be ornamental as well as functional. The design of the gates, of course, depends entirely on the architecture of the house, the fence or area surrounding them and on their purpose.

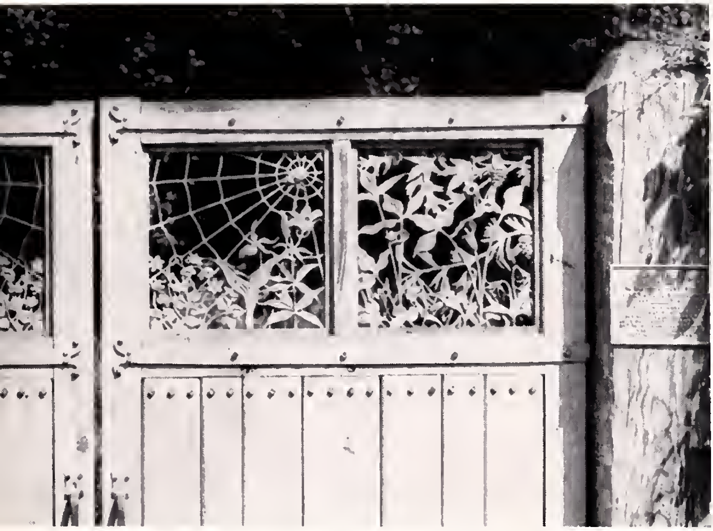
The material for the gates is essentially that of fences. Locust posts are undoubtedly the best, at least the most long lasting, and should be set deeply enough and in concrete so they will resist the banging and constant use of the gate itself. Usually the gate looks better and is more part of the landscape if it has some sort of a finial on the top of the posts. This may be of very simple design similar to that of the upright board fence or, with a more elaborate fence or dignified house, have a turned finial reminiscent of the beautiful ones of early houses.

It is important in designing gates and constructing them to make sure that they are presentable from both sides, if that is necessary, or that the front face is beautiful and all the construction is in the back. This is in many cases very difficult to achieve but with a little study and caution the construction may be part of the design and, therefore, presentable in itself. On the small property gates are rarely necessary but if they are they should be treated as a very important accessory and designed with the greatest care and attention to detail.



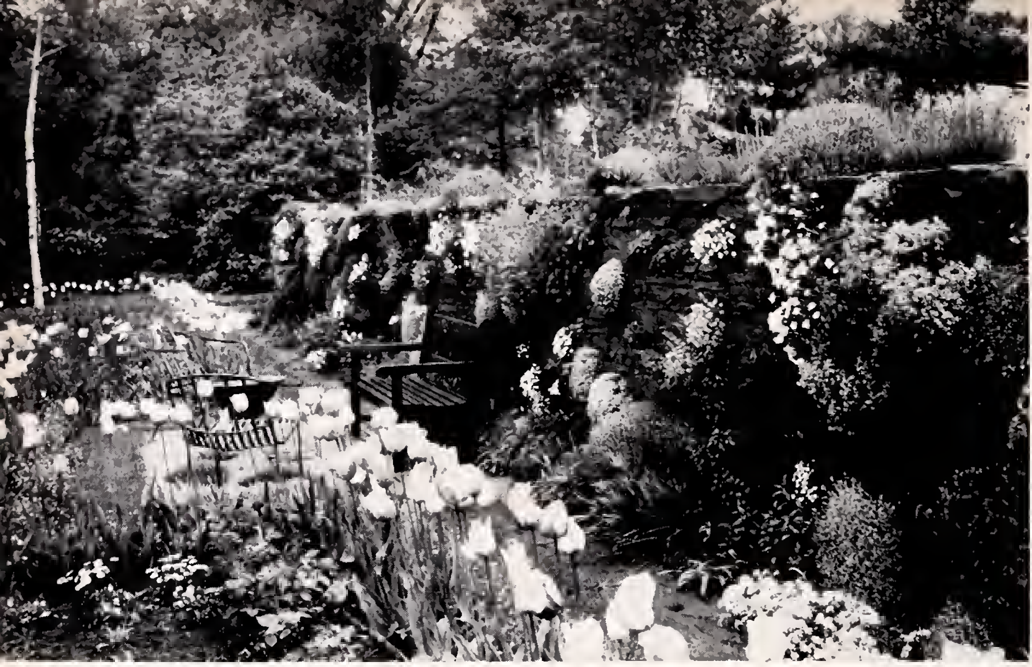
This gate to the Brooklyn Garden's Fragrance Garden for the Blind was designed by Miss Charlotte Mentges, who at the time was a member of the Garden's staff. The flowers are "pinks." The gate is flat black in color; the blossoms are covered with gold-leaf.

Louis Buhle photos



Upper portion of gates to the Woodland Garden, Brooklyn Botanic Garden. Spiderweb and Wildflower designs are by Eva Melady; they are rendered in bronze, as are the strap hinges and other ornamentations. The wood is oak. Over-all design of gate by members of the Garden Staff.

Entrance to the Botanic Garden's Ryoanji Temple Stone Garden is gained through this gateway. The original (of which this is a replica), was constructed in Kyoto, Japan, five centuries ago.



McFarland photo

A tall retaining wall with planting pockets takes skill and practice to build. Unless local workmen are accustomed to doing such work, this type of wall is difficult to achieve.

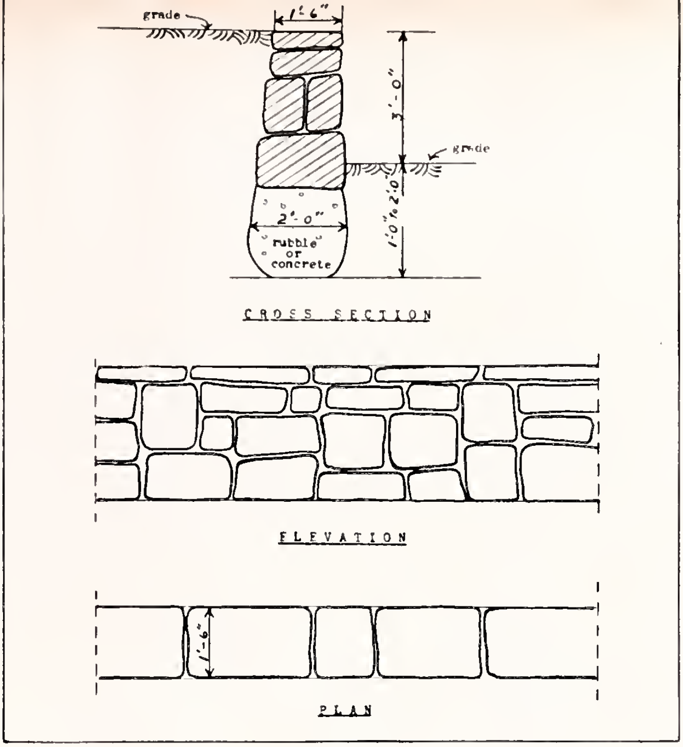
WALLS OF MANY KINDS

For many purposes and situations

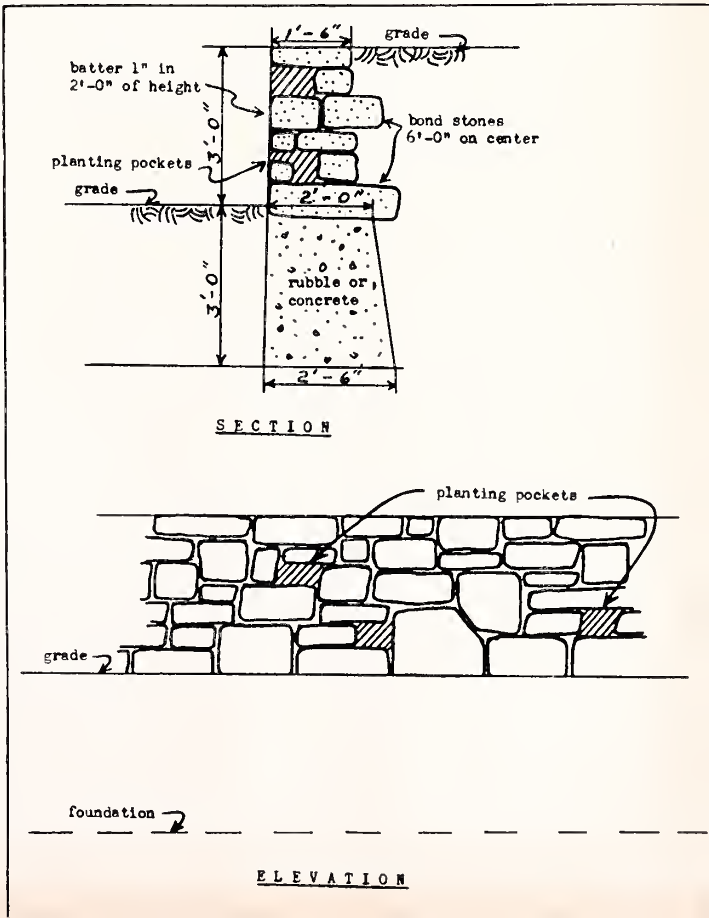
WALLS are frequently a necessity, sometimes a luxury, and often an alternative to fences or screen planting. Whichever they are, their success depends on choosing the type of wall best suited to its surroundings as far as looks go, and also to the local conditions of both material and labor. For example, in sections of the country where there is little or no local stone except round cobblestones, it is unwise to try to build a good dry-laid stone wall or even an attractive masonry wall. It is far better to settle for concrete, concrete blocks, or brick than to import expensive materials where even the best of local masons is not used to laying stone and will probably do a second-rate job. Where stone is plentiful, a stone wall is probably the least expensive of all; and building one, particularly without mortar, is an art even the veriest amateur can learn with a little patience.

Retaining Walls

The wall that is most likely to be a necessity is the retaining wall. It is, as the name implies, a way of holding up earth from a lower to a higher level. It takes the place of a bank or slope; and while it is more expensive to build than a plain bank, it has the great



Detail of dry stone retaining wall.



Detail of dry stone retaining wall with planting pockets.

Roche photo

A dry wall with earth pockets makes it possible to grow plants in the wall. Pockets are made while the wall is being built.

advantages of requiring little or no maintenance and of giving considerably more room than the bank itself does. A narrow level in front of a house can gain a considerable amount of width if a low retaining wall is built at the bottom of a slope, and fill put in behind the wall. A wall takes about a foot or 18 inches for 3 feet of height while a bank takes 6 to 9 feet for the same height.

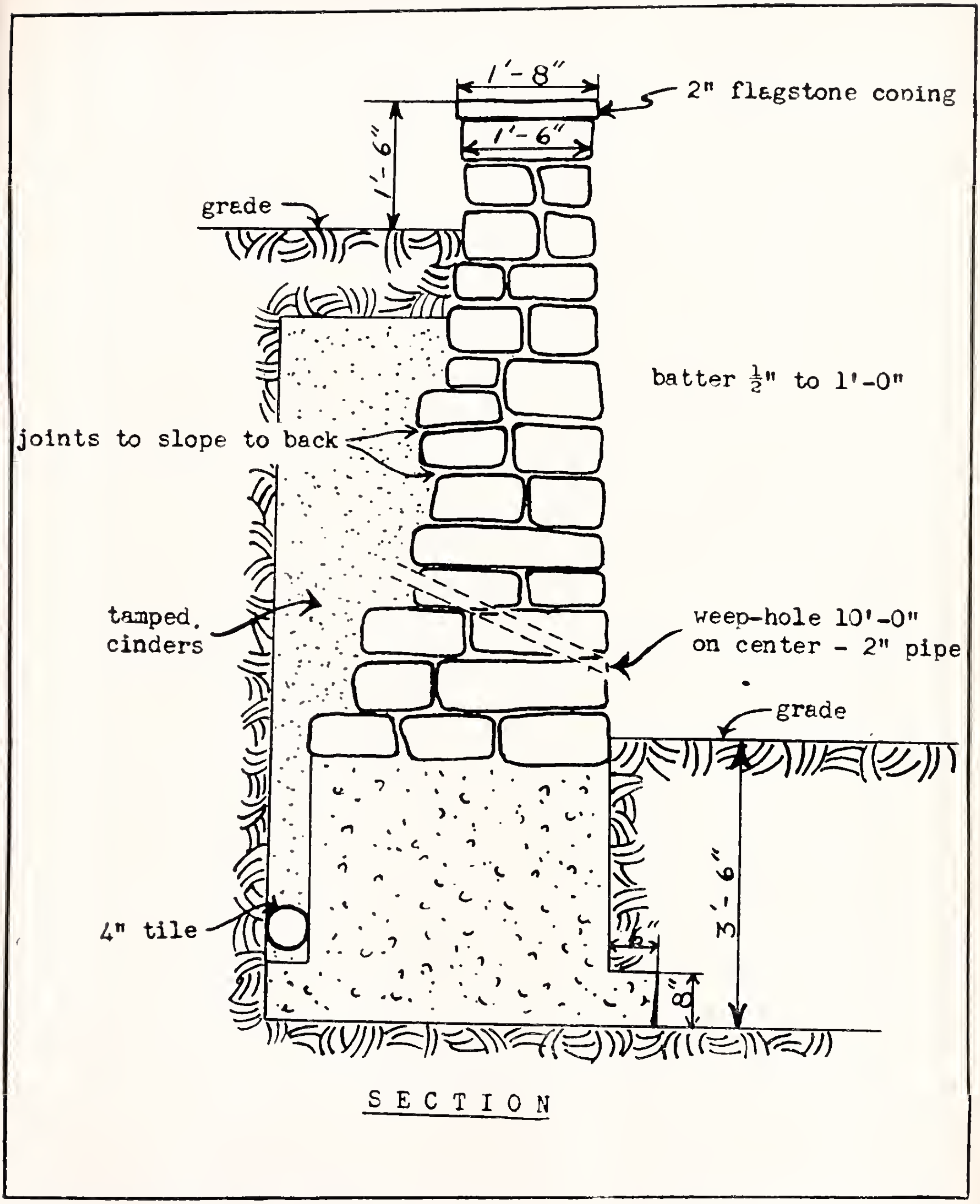
The wall may be of brick, stone, or concrete; a stone wall may be either a masonry wall (*i. e.*, laid with mortar or in cement) or a dry wall (local stone laid without any mortar in the joints). Our ancestors were capable of laying dry stone walls to considerable heights. Present-day masons and most amateurs should probably not attempt a dry wall much over 3 feet in height. Masonry walls of brick, stone, or concrete can go to considerable heights and if soundly constructed will cause no trouble by cracking or breaking or bulging. Any retaining wall of great height, however, had better be left to the professional mason, as it takes a crew of men to wheel mortar, pour cement, or to build either stone or brick with scaffolding to the top.

Usually, the simpler a retaining wall is in design and the more directly it shows its construction, the better-looking and safer it is. If the wall is of local stone laid without mortar, the fewer the small stones that can be in it, the more substantial it looks. Also, the gradation from large stones at the bottom to thinner stones at the top gives it a feeling of firm foundation and safety. Even for a masonry stone wall, these same principles of stone selection apply. In a brick retaining wall, the common bond (ordinary) pattern of laying the brick is less distracting to the eye and usually more attractive than more elaborate patterns.

Free-standing Walls

Free-standing walls may be desirable either for decoration near a garden, for privacy, or for windbreak. Around a living terrace, a wall 15 to 18 inches high furnishes a great deal of additional sitting space and gives definition to the terrace itself. Such a wall is usually best built of smooth-surfaced stone or of brick or concrete, rather than of rough stone, and should have a flat cap of brick or flagstone projecting at least 1½ inches from the face of the wall. Low boundary walls around the garden or on a property line do a great deal to add to the dignity and year-round attractiveness of a place. They require much less maintenance than painted fences or shrubbery hedges or borders of any kind.

Where taller walls are used for privacy, there is some likelihood of gaining privacy at the expense of cutting off all air circulation. In such a case, a brick wall, with openwork brick at the



Detail of masonry wall.

top or even throughout the height of the wall, will still give privacy but allow the air to come through. Most interesting and colorful patterns can be worked out by leaving out bricks to form openwork patterns. Such a wall is particularly appropriate as a boundary to a garden or near the street where a tall solid wall might look inhospitable and forbidding.

Plantings for Walls

It is usually desirable to have some planting on or near a wall to prevent its looking too bare and cold. If **vines** are to grow on the wall, provision for them must be made at the time of building. There are a few vines that cling to brick, stone, or concrete with their own holdfasts. The only preparation necessary for these is to be sure that the wall foundations do not project too far in front of or behind the wall, so that the vines can be planted close to the wall. Careless masons frequently make their footings 6 or 8 inches wider than the wall right at the grade and it is impossible to get any vine anywhere near the wall. For other types of vines that are desirable on the wall, wood plugs inserted at the time of building will permit fastening wires or trellises to the wall at a later date. If the plugs have not been put in during building, it will be necessary to insert them with a drill or to put in expansion bolt plugs for espaliers or vines.

The vines suitable for all types of walls are discussed in the Brooklyn Botanic Garden's HANDBOOK ON VINES and the lists there are complete.

Usually it is better to use a considerable amount of restraint in placing vines against the wall, unless the wall is actually so badly built that the aim is to cover it up as quickly as possible. A slight tracery of vine against a sound brick, stone, or concrete wall is far more interesting than a solid mass of foliage. If the objective is a solid green line, the expense of building a wall might as well have been omitted in the first place and either a tall hedge or a wire fence covered with the vines put in instead.

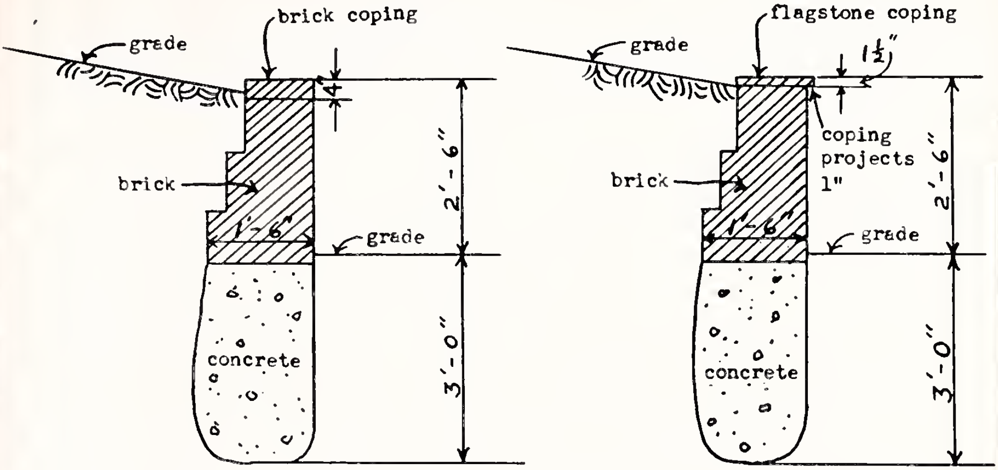
Against the wall with a very plain surface, notably of brick or concrete, a **shrub or tree** that throws interesting shadow patterns will be more effective than planting on the wall itself. The best choice for this purpose is a woody plant of rather open and gnarled habit, so that it has few branches and a very clean-cut silhouette. Burning bush (*Euonymus atropurpurea*), laburnum, viburnum, and magnolia are good examples of plants casting bold shadow patterns.

A wall treatment seen frequently abroad but rarely in this country is the **pleached trees** above a free-standing wall to give greater height for privacy or for shade than would be possible with a wall alone. For example, where a neighboring house stares down on a garden, a wall tall enough really to screen it would be prison-like. Instead, a 6-foot wall with trees like hawthorns (*Crataegus*), lindens (*Tilia*), or ironwood (*Carpinus*) planted close to it can provide the desired screen and give the effect of a tall green hedge on top of a wall, without taking much room in the garden.

Similarly, where privacy is needed and a tall wall is not indicated, a light fence on top of a wall will allow a screen of vines to grow without cutting off all air circulation. Frequently this will still be within the zoning laws of suburban communities that do not allow walls taller than 4 feet on any property line. Even wood posts set into the wall at the time of building it, with chains between, will allow heavy vines like wisteria or bittersweet (*Celastrus*) to give quick and comfortable screens without too forbidding an amount of masonry.

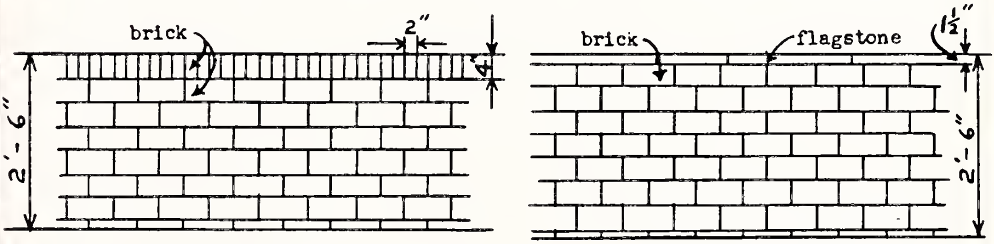
Construction

Dry stone retaining walls are built of native stone in all sizes from small pieces used to fill in the cracks to field stone as big as can be handled conveniently. The stones must be laid at right angles to the line of batter (slope) so that there is a slight tilt to the back of the wall. They are laid level



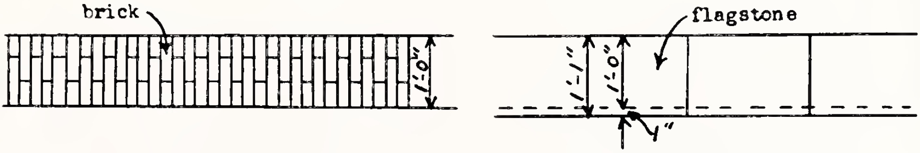
Typical section through wall with brick coping

Typical section through wall with flagstone coping



Elevation of wall with brick coping

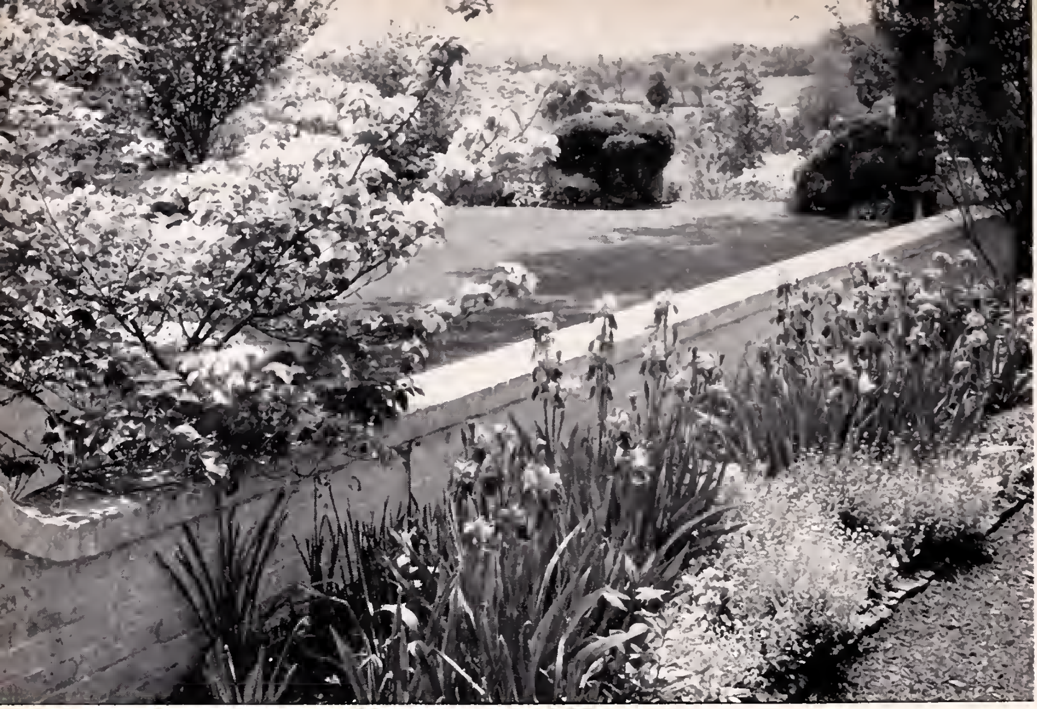
Elevation of wall with flagstone coping



Plan of wall with brick coping

Plan of wall with flagstone coping

Details of brick retaining walls.

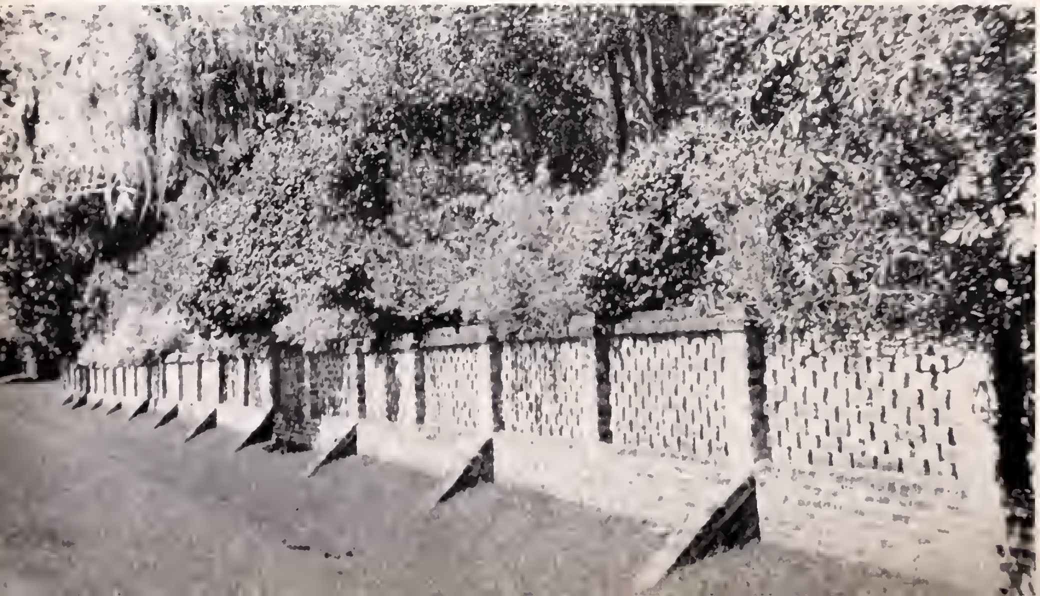


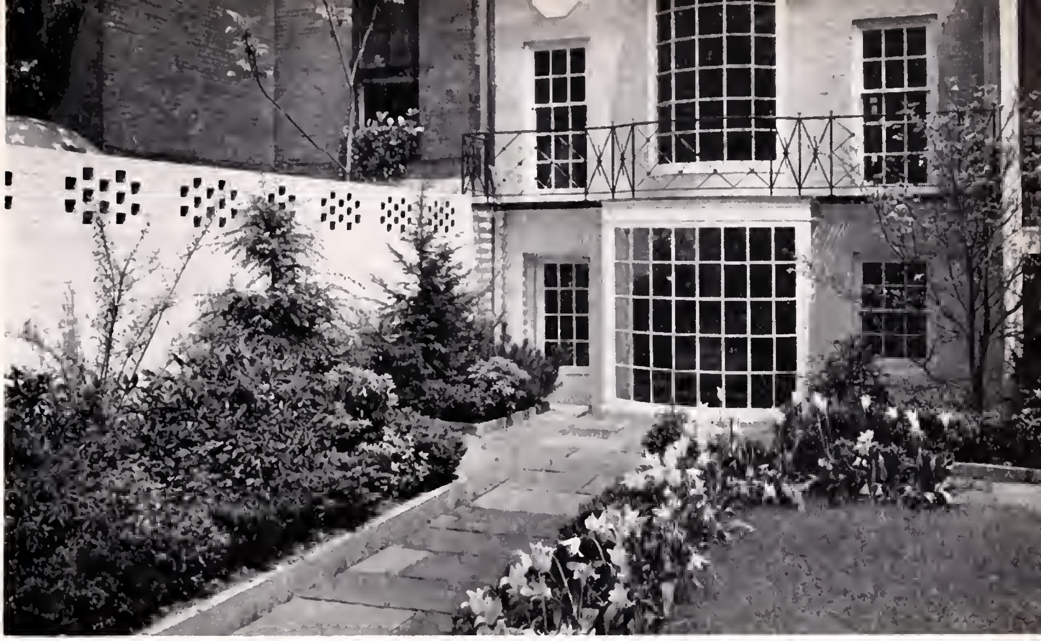
R. A. Smith photo

A low brick wall, laid in common bond with an overhanging brick cap, divides the garden from the lawn and gives excellent background for flowers.

Pierced brickwork, made by omitting sections of brick, gives texture and fine play of light and shadow; a plain wall of this height would be forbidding. Flying buttresses brace and enhance the design of the wall.

Buhle photo



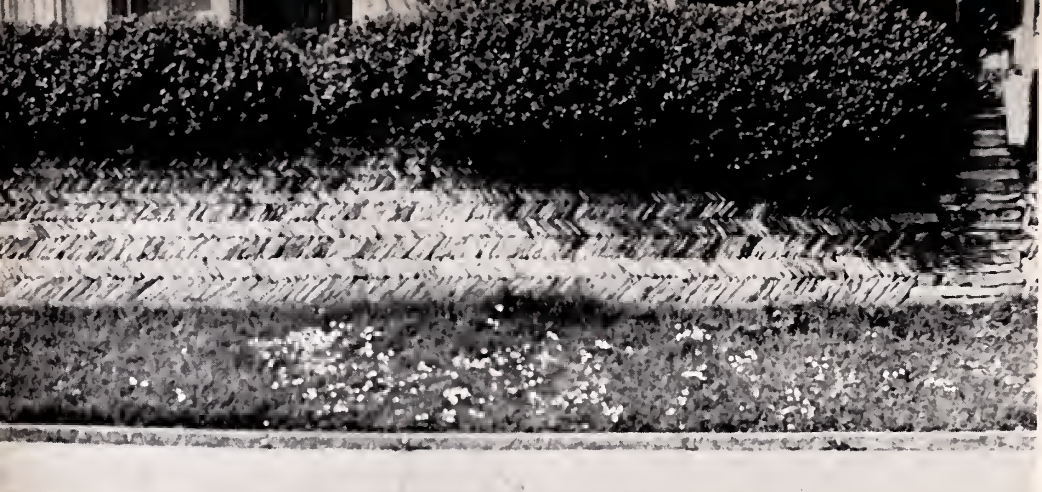


Gottscho-Schleisner photo

A small city garden gains privacy with a brick wall. The pierced top of the wall admits air and gives a feeling of delicacy that a solid brick wall would lack.

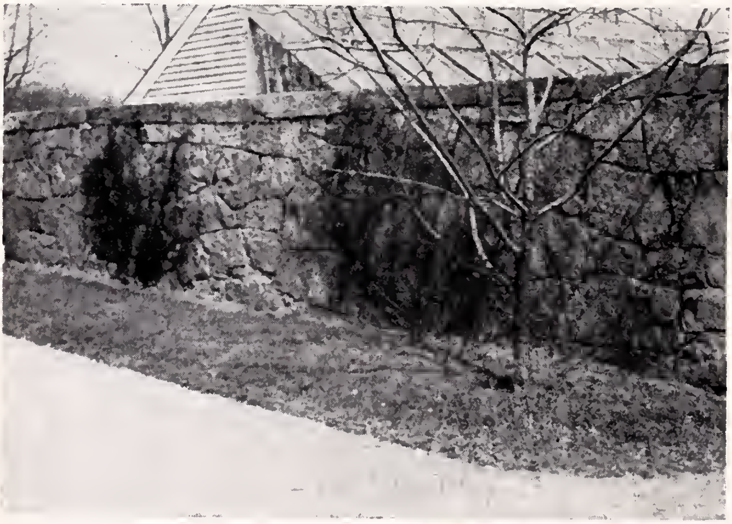
A serpentine wall of brick need be only 4 inches thick. The economy on the number of bricks may be outweighed, however, by the difficulty of finding a mason who knows how to lay such a wall.

Gottscho-Schleisner photo



Buhle photo

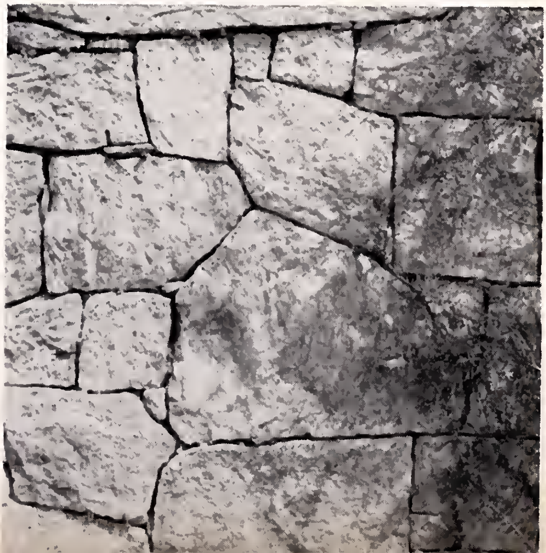
An old herringbone wall in Cornwall, England, shows unusual use of thin, local stones (slate) laid in diagonal courses. Note overhanging hedge.



An old, exceptionally fine example of the art of stone-fitting so that no mortar is needed.

Photos courtesy Mrs. Robert P. Anderson

Close-up of section of above wall. This type of work is possible only where the local stone cuts cleanly and local masons know the art of building of such a wall.



right and left, and so that flat rather than rounded faces show. The wall need extend only 1 to 2 feet below grade, and the foundations may be rubble, or concrete, or large stones laid dry, whichever is cheaper. The width of the wall at the bottom of the footings must in no case be less than one-third of the total height of the wall, and the width of the top of the wall is usually 18 inches. The front face should have a batter or slope of 1 inch in 2 feet of height. The back of the wall should slope so that at no point in the wall is the thickness less than two-fifths of the vertical distance from the top of the wall to that point. Bond stones at least 2 feet 6 inches in length should run back into the bank approximately every 9 feet; they keep the wall from tipping and are most important.

The coping or top course of the wall should be at least the full width of the wall (18 inches). If some stones are wider than others and project into the grade behind, the irregularity adds to the charm of this type of wall.

Dry stone retaining wall with flower pockets. This wall is built the same as any dry stone retaining wall, with the following modifications. Earth is packed between the ends of the stones, as if it were mortar, and a bed of earth is laid on top of each course (horizontal layer of stones). From the start of the wall the soil must be rammed in behind and between all the stones. The success of the wall depends upon tight ramming and too much importance cannot be placed upon it. In approximately every 9 square feet a pocket should be made of topsoil and sand in equal parts, tightly rammed, just back of the exposed face of the wall, to allow for planting.

The wall should extend at least one foot below finished grade and the stones below grade are firmly laid without soil on a hard earth bed.

Stone retaining walls laid in mortar. Masonry walls of native stone may be laid in good cement mortar (see p. 51). Foundations of rubble or concrete must extend to frost level, which varies in different climates. The stones must be laid level right and left, at right angles to the line of batter (slope), and so that flat rather than rounded faces show. The joints on the face must be as tight as possible and raked or scratched so that the face of the wall looks like a dry wall. Great care should be taken that the mortar is cleaned from the face of the stone.

Weep-holes of 4-inch iron pipe or tile extending through the wall, 6 feet apart, allow for drainage and are essential to keep the wall from cracking.

The coping at the top of the wall may be made of native stones from 2 to 4 feet long, laid with flush joints, showing as little mortar as possible; or flagstone 1½ inches thick may be used, in good mortar with flush joints, and projecting 1½ inches from the face of the wall.

Brick walls. Strip topsoil from the area to be excavated and pile in a convenient place for later use. Excavate for walls and footings to solid earth below frost line in the locality.

Foundations for brick walls may be built of common brick or concrete, whichever is cheaper. They extend to the frost line.

If the foundations are of concrete the proportion of cement, sand, and crushed stone or gravel should be 1:3:5.

From 2 inches below finished grade, bricks are laid in first-class cement mortar. The easiest pattern to lay is known as common bond with a course (layer) of headers every fifth course. Mortar is composed of one part cement and three parts sand.

The coping or top layer may be of brick with joints on the top struck flush, or of rectangular flagstone 2 inches thick projecting 1½ inches from the face of the wall.

Brick retaining walls are built in the same manner but increased in thickness so that the width at any point is at least one-third of the distance from the top of the wall at that point. They must have weep-holes of iron pipe or of omitted bricks every 6 feet, close to the lower grade for drainage.

PLANT CONTAINERS OF WOOD

THE boxes that plants grow in can and should be designed for attractiveness as well as use. They should be permanent and have an air of belonging to the house, terrace or porch where they are to be placed. Containers having distinctive design are seldom available as stock items from local sources. Some of the best containers are homemade. Here are suggestions for making them.

A basic design can be copied and, by the subtraction of a molding or addition of legs changed to blend with contemporary or older homes.

Redwood and cypress make the best outdoor boxes for reasons already stated. Pine, cedar or poplar are equally good woods for painted and lined boxes and are easy to work with.

Include in your construction plan means for the removal of permanent plantings when the plants become rootbound, particularly when large boxes are employed, *i.e.,* removable sides, metal liners with side hole lifts, pots to fit the box.

Plant boxes must be built with air and drainage space underneath. They must have depth enough for strong root growth, probably a minimum of 7 to 8 inches.

A waterproof glue is a necessity for holding mitered corners together on a box to be filled with soil, regardless of inside bracing. Water-resistant glue is sufficiently strong for boxes which are lined or have other inside containers.

Screws are best for holding boxes together. On redwood, screws or nails must be aluminum, brass, cadmium plated, or galvanized, never steel. Steel and redwood apparently react chemically to hasten deterioration.

Finishes depend on settings and type of box:

(1) paint to match house or trim.

(2) redwood, for elegance—three coats finishing oil, dull finish; redwood, rustic—rubbed as many times as your patience holds with boiled linseed oil and turpentine, mixed half and half; redwood, natural, no finish, weathers gray.

(3) cypress—rubbed with oil and turpentine for indoor finish; cypress, natural, weathers silver-gray.

This container-grown crab apple 'Red Jade', pruned to emphasize its weeping habit of growth, makes a fine small tree for a terrace.

Brooklyn Botanic Garden photo

Plants grown in containers may be shifted from place to place to brighten the terrace, as each one comes into bloom. When the crocuses fade, they are transplanted to the garden, and tubs are replanted with potted petunias.

Jeannette Grossman photo

Simple kegs and tubs, treated with wood preservative, make good plant containers. They may be painted neutral colors. Make drainage holes in the bottoms. Petunia 'White Magic' flourishes in this keg.

George Taloumis photo

Triangular redwood box with thread-leaf Japanese maple (*Acer palmatum* var. *dissectum*).

SUPPORTS FOR VINES

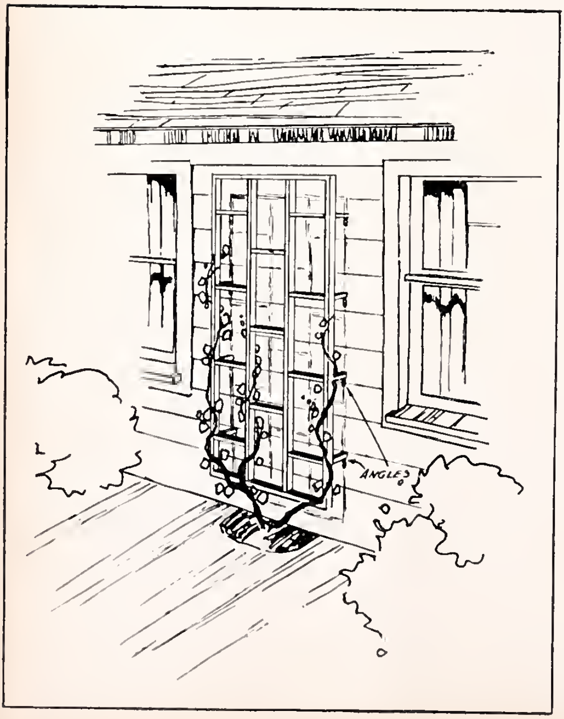
ANYONE who has tried to paint a house or have it painted when it was rather overrun with vines knows how important it is to have the proper support for the vine itself and be able to remove both vine and support. There are essentially three kinds of vines, each of which needs a special kind of support.

The first is the vine that has to have some sort of support to which it can be tied. This, of course, includes climbing roses, grapes, espaliers of all kinds and many of the clematis family. These may be served by either wires, rods or wood well designed and put in the form of a permanent trellis which is screwed to the house and can be taken down, vine and all, when it is time for repairs or painting or any other work behind it or around it.

The second type of vine has tendrils with which to cling to any kind of support. One of its great troubles is that it usually clings to everything and when it comes time to take it down, it is a mass of stems, leaves and tendrils. Usually a wire support of some kind is best for this type since the tendrils are rather small and reach out greedily for a support their own size. Wire mesh has the advantage of enabling one to see where the vine is to go and to keep it within those bounds. Among these vines are some clematis, cup-and-saucer vine, Virginia creeper and silver lace-vine.

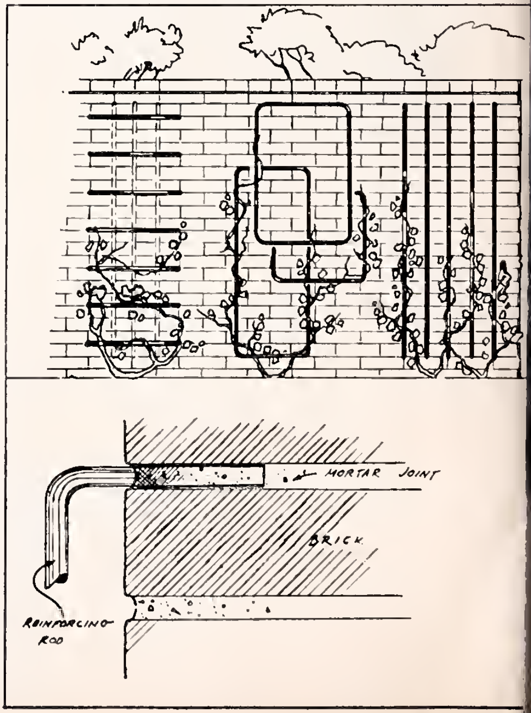
The third type is the vine that twists around the support, usually with very heavy trunks which are inclined to tear a light support to pieces. These vines are almost boa constrictors in their crushing power and can tear a light wood lattice or a porch trellis or a fence into bits in a very few years. Wisteria and bitter-sweet are typical examples. They

Useful for supporting vines against wooden walls are wooden vine supports. These should be designed to harmonize with the architecture of the building. They should be attached to the house with metal angles and screws, to permit the taking down of vine and all when painting.



The most permanent kinds of vine supports are made of reinforcing or wrought iron rods. They form a definite pattern against the wall or building, and are strong enough to support wisteria and other rampantly growing vines.

Drawings by William J. Johnson

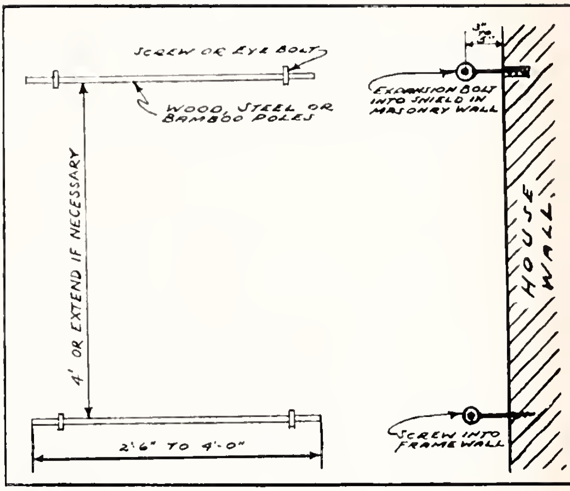


should have very substantial supports of plumbing wire or heavy cable well out from the house so that the vine can be kept ruthlessly to its own support and not tear shingles and trellises apart.

The most beautiful vines wrongly supported or trained can be a nuisance and a great disappointment.

To keep future maintenance at a minimum, don't even consider planting a vine in your homescape without providing the proper type of support. The accompanying illustrative material is self-explanatory.

There are, of course, vines such as English ivy, euonymus and clinging hydrangea which cling by suckers to masonry. Since they need no supports they do not, of course, come within the scope of this article. Such vines should be used *only* on stone or masonry walls.


SCREW OR EYE BOLT
WOOD, STEEL OR BAMBOO POLES
4' OR EXTEND IF NECESSARY
2'-6" TO 4'-0"
3" TO 5"
EXPANSION BOLT INTO SHIELD IN MASONRY WALL
SCREW INTO FRAME WALL
HOUSE WALL

L.A. Mary Deputy Cattell

Typical detail of support for espaliered plants.

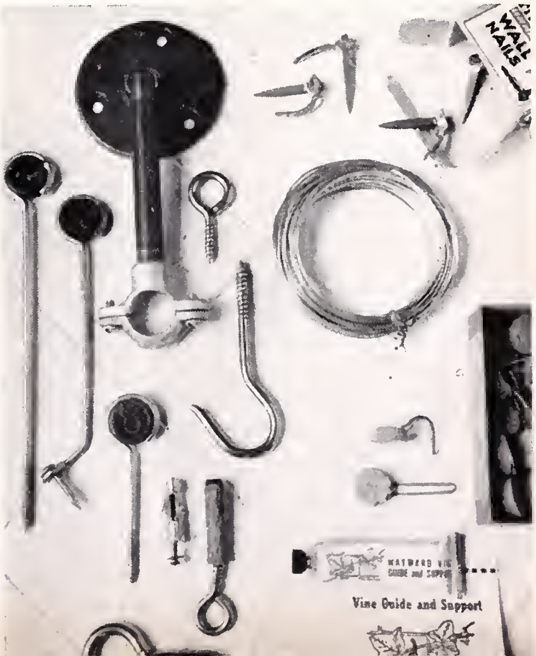
* * *

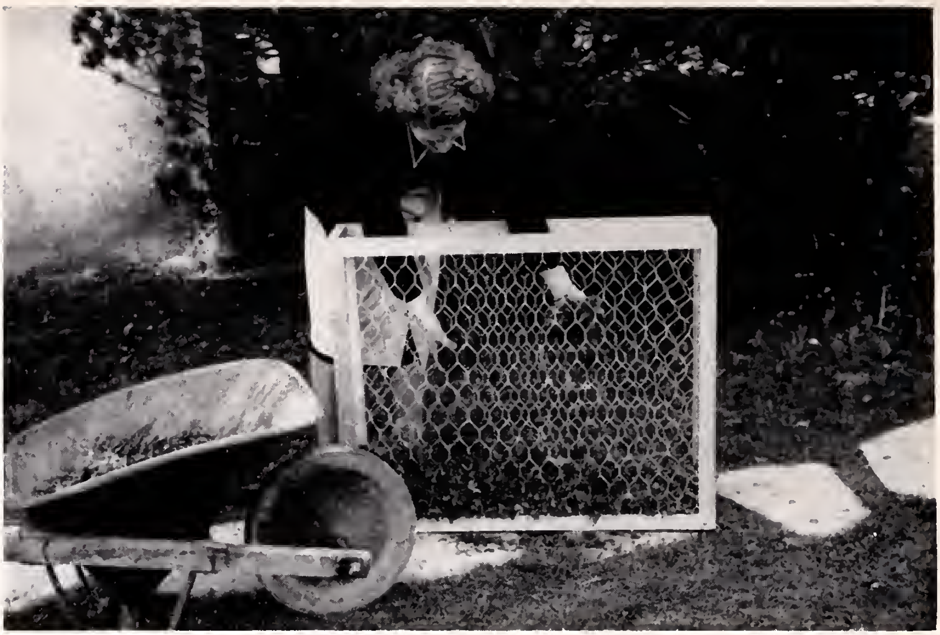
Paul F. Frese photo

Vines trained along wire supports are used here to create a pattern against the side of the house. With periodic pruning, they need not obscure the windows.

The various types of supplies needed to train plants against walls and buildings, such as screw eyes, hooks, expansion bolts, steel pointed wall nails and wire; available in hardware stores and garden shops.

Roche photo





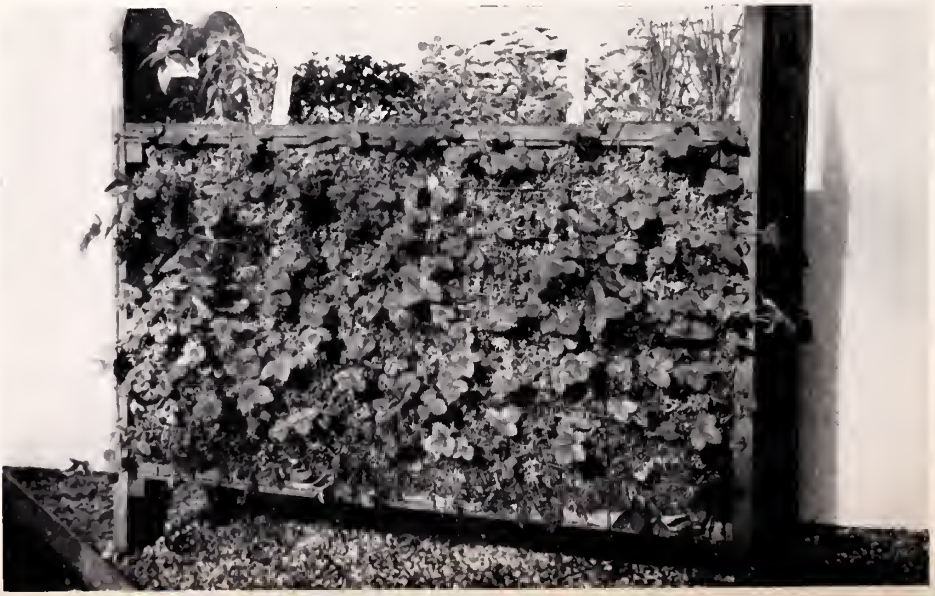
Filling a wire-mesh box with sphagnum moss, preliminary to its almost magic transition to a vertical garden.

VERTICAL GARDENS

FROM Switzerland comes this novel idea for building a vertical garden in the form of a wire-enclosed wall. Sphagnum moss or coarse peat is the growing medium, pressed within a wire frame. Many kinds of flowering and foliage plants will thrive in these containers when watered and fed, as required. A detailed article in the Brooklyn Botanic Garden's HANDBOOK ON GARDENING IN CONTAINERS explains how to make and care for these gardens.

Portable strawberry "wall" with small collection of kitchen herbs growing on top.

Buhle photo



ARBORS AND SHELTERS

AN arbor or, shades of the Victorian era, a summer house can be either a delight or an eyesore, depending upon how well it is designed. An arbor leading from one section of the place to another or as a place to sit in the shade of vines to rest can be a delight. Sometimes attached to the house, an arbor gives shade in the hot summer sun and because of its rather light construction allows all the winter sun to come in.

In any case an arbor in itself should be of fairly light construction, very carefully designed to fit its site and the architecture of the house, and to be attractive even in the season when its vines are bare. Nothing is less appropriate to the average home landscape than the so-called rustic arbors consisting of unpeeled posts and overhead members loosely secured and unpresentable. The loose bark has a way of peeling and dropping down for the first two or three years and from then on the posts are knotty and all the untreated wood starts rotting. The same form and shape of the arbor can be done in stock lumber treated to weather to the grey color of the winter landscape and is much more permanent. It will also be much easier on the pruner who is trying to get the vines in control.

Shelters have an unfortunate connotation of the horrors of the Victorian age when they were usually of cast iron—thoroughly uncomfortable and in places where no one would ever want to sit down or relax. The only reason for a shelter is literally to give shelter for one purpose or another. It may be shelter

Shade overhead and protection from inclement weather contribute to the enjoyment of this open sitting area with its commanding view of the water.

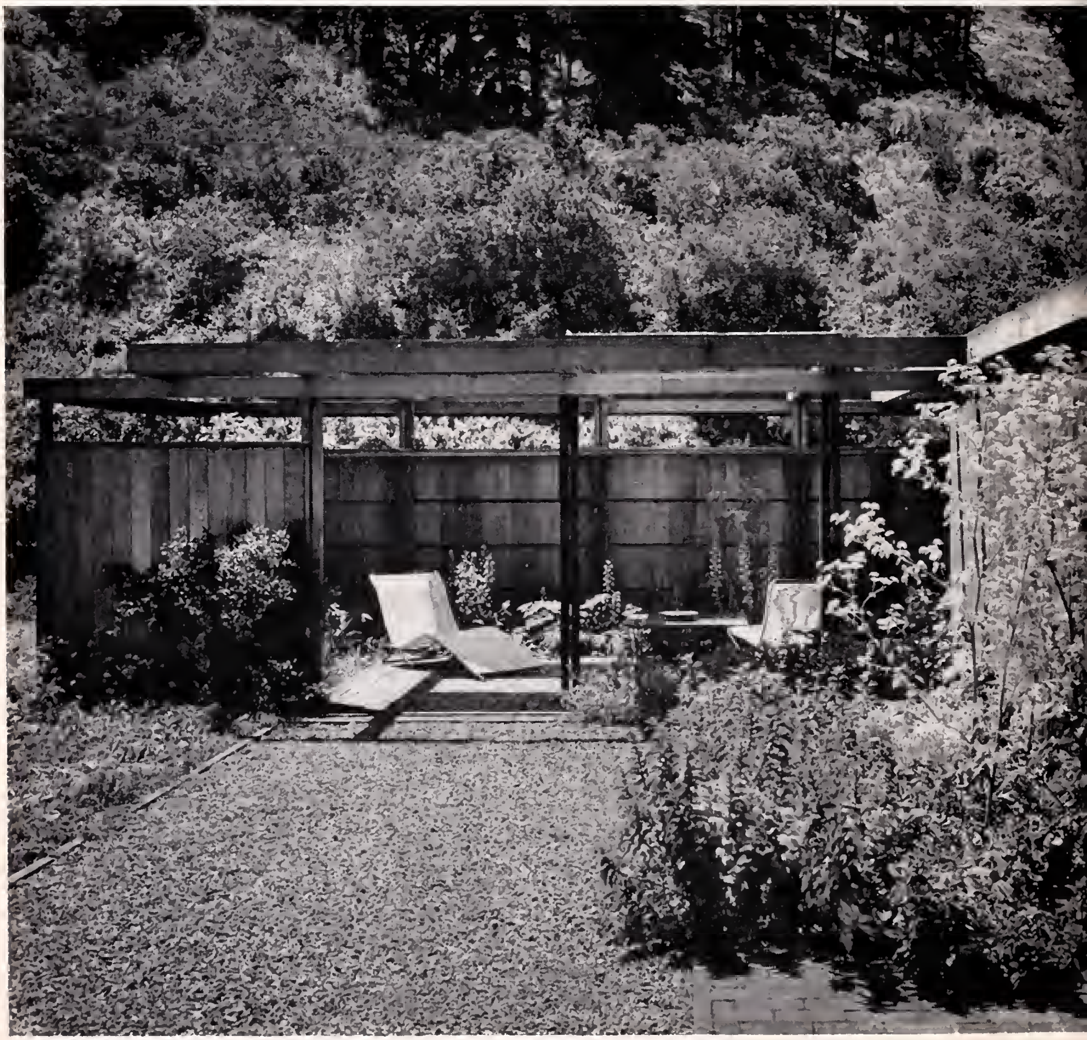
Gottscho-Schleisner photo

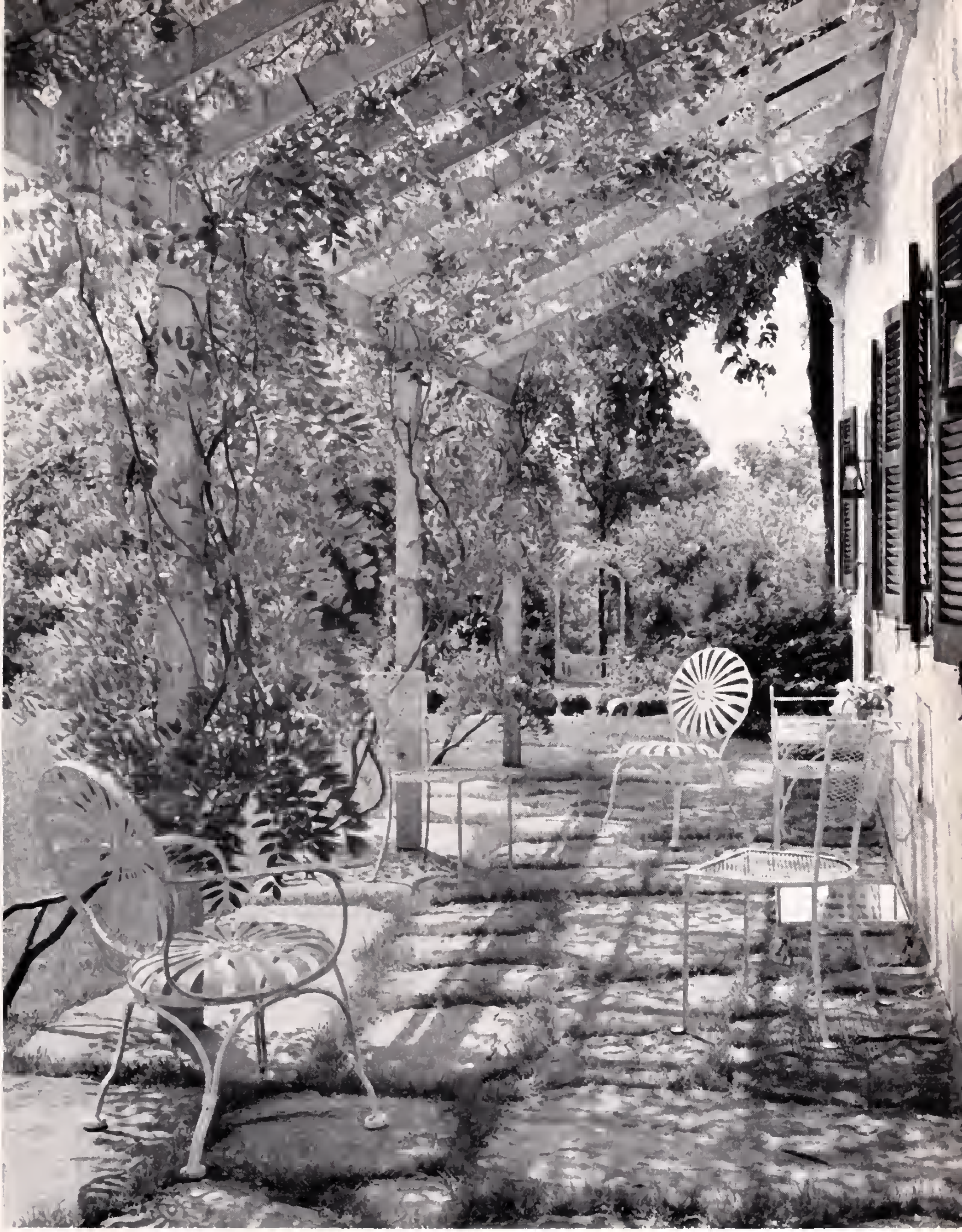
from the sun, from the wind or just from people. The eighteenth century did beautiful ones and many of them can be copied. Some of the best examples are in Colonial Williamsburg.

Most shelters should have seats in them. There is no point in going to a place to relax only to find that it is necessary to carry in furniture. In general the material and the design of the arbor or shelter must correspond to the architecture of the house and to the needs of the family that uses it. Otherwise it is both an eyesore and a non-necessity. In other words think twice before building an arbor or a shelter and then be sure it is very well designed and in keeping with your own needs and the rest of your landscape.

Bold design and simple structure make an outdoor living room both comfortable and attractive in its wooded surroundings.

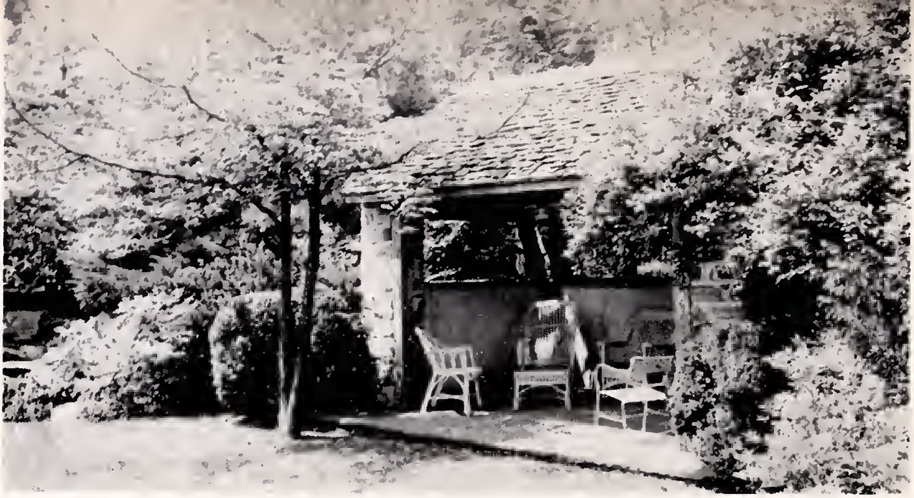
L.A. Douglas Baylis *Baer photo*





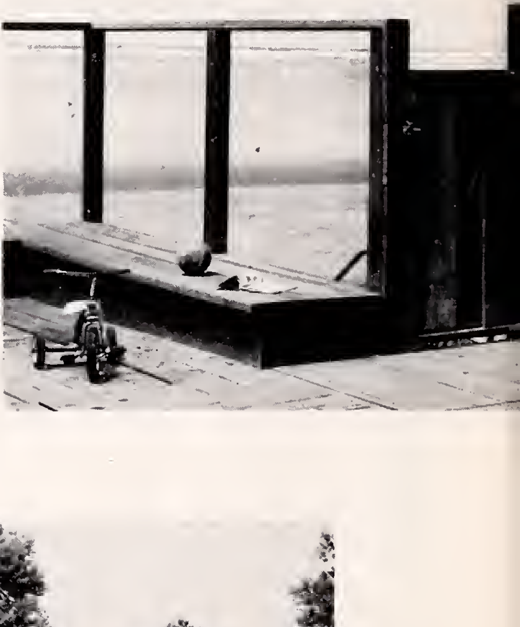
R. A. Smith photo

A simple arbor attached to a traditional house provides pleasant shade from wisteria vines for summer living.



L.A. A. F. Brinckerhoff *Photo courtesy L.A. Alice R. Ireys*

This outdoor living room is closed on the sides. The shingled roof provides protection in all kinds of weather and recedes into the well-planted background.

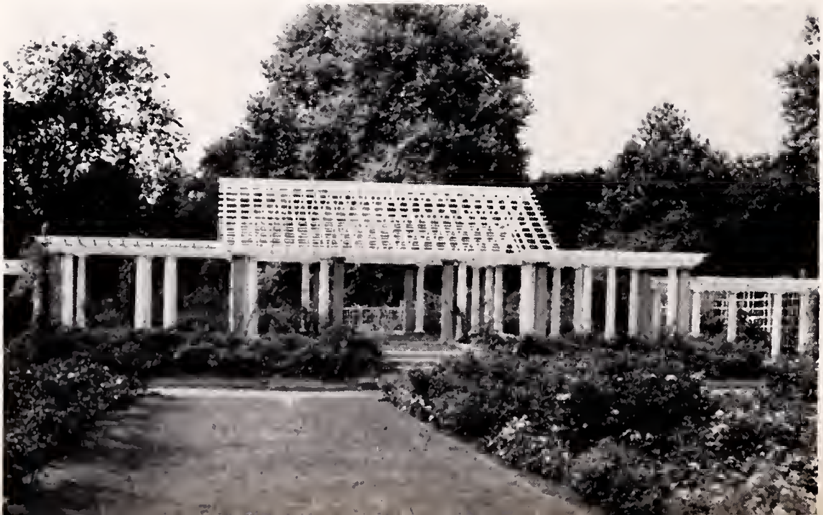


A glass windbreak surrounds the deck of this property at the seaside. The glass permits an unobstructed view of the sea and prevents young children from wandering away. The latch on the gate is placed high out of reach of children's hands. Under the seat is storage for toys and garden tools.

L.A. Chandler Fairbank
Jeannette Grossman photo

Rose Pavilion and Terrace, Cranford Memorial Rose Garden, Brooklyn Botanic Garden. Climbing roses trail over the open framework, except when it is freshly painted. It was designed by Harold A. Caparn.

Louis Buhle photo



OUTDOOR FURNITURE

OUTDOOR furniture is a problem, an expense and sometimes a nuisance. There are, however, certain principles of comfort and appropriateness which, if observed, will help eliminate some of the trouble. In the first place, the only comfortable materials on which to sit are wood and fabric. Both iron and stone are too hard and at most seasons of the year either too cold or blisteringly hot. Therefore, the seat of the furniture should not be of those two materials.

Most stock outdoor furniture is inclined to be heavy, cumbersome and rather badly designed. The purchaser needs to look it over very carefully to see whether it takes too much manpower to move it or whether it is fairly portable. The opposite, of course, is the aluminum and fabric chairs and benches which have an unfortunate way of blowing in a high wind and sometimes landing in the middle of a lawn or swimming pool, to everyone's consternation. Both of these extremes must be avoided.

If the benches are entirely of wood it is important to get them made for outdoor use. If they are to be left to weather naturally they should not be nailed or screwed together. They should be hand pegged or glued with ship glue so they will withstand the outdoor elements. They should also be treated with wood preservative and prepared for hard

A wood bench of simple proportions and pleasing design is the perfect choice under the gnarled branch of a dogwood.

Gottscho-Schleisner photo

weather. Otherwise they are likely to disintegrate several years earlier than they should. If the furniture is wood to be painted it needs to be made much the same way but pegging is not so imperative. Screws or nails can be covered with paint. Wood or iron outdoor furniture is best painted with automobile paint. A coat of automobile under-coating and a coat of the almost limitless colors on the charts will enable you to protect the furniture. Instead of having shabby, peeling furniture each August it may stay neat for two seasons.

The appropriateness of outdoor furniture to its site is most important. A chrome and fabric chair in the middle of a wooded spot looks like a sore thumb. Equally, with a sophisticated house a rustic chair or seat is a completely wrong note. Choose or design all furniture in terms of its suitability to its site and its comfort for use.

F. S. Lincoln photo

A substantial table with benches attached for the picnic area or outdoor dining place. Such tables can be purchased ready-made or built at home.

Welch photo

Bench in the Fragrance Garden at the Brooklyn Botanic Garden. The seat is slightly concave, for sitting comfort. This and others in the same style are made from fragrant woods.

McFarland photo

The circular pool is deep enough for planting water lilies and gives the feeling of enlarging the spring garden by reflecting the flowers.

GARDEN POOLS

Versatile and charming, they can be used in many ways

POOLS are deservedly one of the most popular features of the outdoors. Their possibilities are almost limitless and the range of shape, size, material, and location makes it possible for water in some form to be a part of almost any place, however large or small. They range from the quiet mirror pool catching the reflections of sky, trees, or flowers, through pools with jets of water or fountains playing in them, wall fountains and dipping cisterns, to pools essentially built for growing aquatic plants. Where there is running or spraying water, the great effect of coolness is not entirely an illusion. The evaporation from a spray of water, particularly if it is thrown against a wall, actually does lower the temperature near it to a considerable extent. Hence, in very hot climates or in a hot corner of the place, a pool may justify its expense as sheer practical climate control.

A pool of any size over 3 feet in diameter or length should be built of reinforced concrete. Pools built of cement or cinder blocks do not hold up well and are almost impossible to make waterproof. Very shallow pools, even if larger than 3 feet, can be formed of sheet lead bent to shape. The local tinsmith can sometimes make such a pool, of not too intricate form, with water-tight seams.

L.A. Walter Leder *Alice Dustan Kollar photo*

There is simplicity in design of the bench, dipping well and sandbox, pictured in the corner of an intimate home garden in Zurich, Switzerland.

Formal pools. In a living terrace or near a house or in a formal garden, the more geometric and regular shapes are usually appropriate. Building the forms for rectangular or square pools is easiest for the amateur to do, and in the proper setting such shapes are most attractive. Circular or free-form pools require a little more skill in getting the exact line in form work, and the forms are perhaps better left to a professional carpenter to build.

Dipping cistern. One of the most thoroughly practical water containers is a descendant of the old rain barrel. A dipping cistern placed at the end of a leader from the house gutters conserves otherwise wasted water from the roof and is most convenient, as its name implies, for filling sprinkling cans and for watering potted plants or seedlings near by. Since these dipping wells adjoin a house wall, they are better lined with either sheet lead or copper than made entirely of masonry. With a house of traditional architecture and of farmhouse character, the old-fashioned **rain barrel** is still a useful object. A wooden barrel, left to weather or painted on the outside, and fitted with a screen on the top to keep out mosquitoes, will last for several years. It is particularly convenient near the cold frame or hot bed where frequent watering of small plants is necessary.

There are thoroughly practical, **ready-made plastic and steel pools**, available for enthusiasts at relatively little expense. They are formal in shape, usually either round or square or oblong, and especially designed to be of the right depth. A little ingenuity can sometimes fit them into more informal surroundings by the use of either planting or native stone laid to project irregularly around the edge of the pool.

The **naturalistic or very informal pool** is the most attractive in many situations. It is also likely to be the most difficult to build so that it both looks well and is soundly constructed. In the rock garden or along the course of a small stream, a pool of irregular form can be built so that it looks as if Nature created it instead of man. Such pools usually must be built of concrete, with the concrete hidden either by a veneer of stone or by sheet lead or copper painted dark so that the man-made material is not obvious. With imagination and ingenuity in treating their shape and by concealing their artificiality with edges of rock or overhanging plants, such pools can be made the *pièce-de-résistance* of an informal garden or a wild garden of any sort.

Planting Around Pools

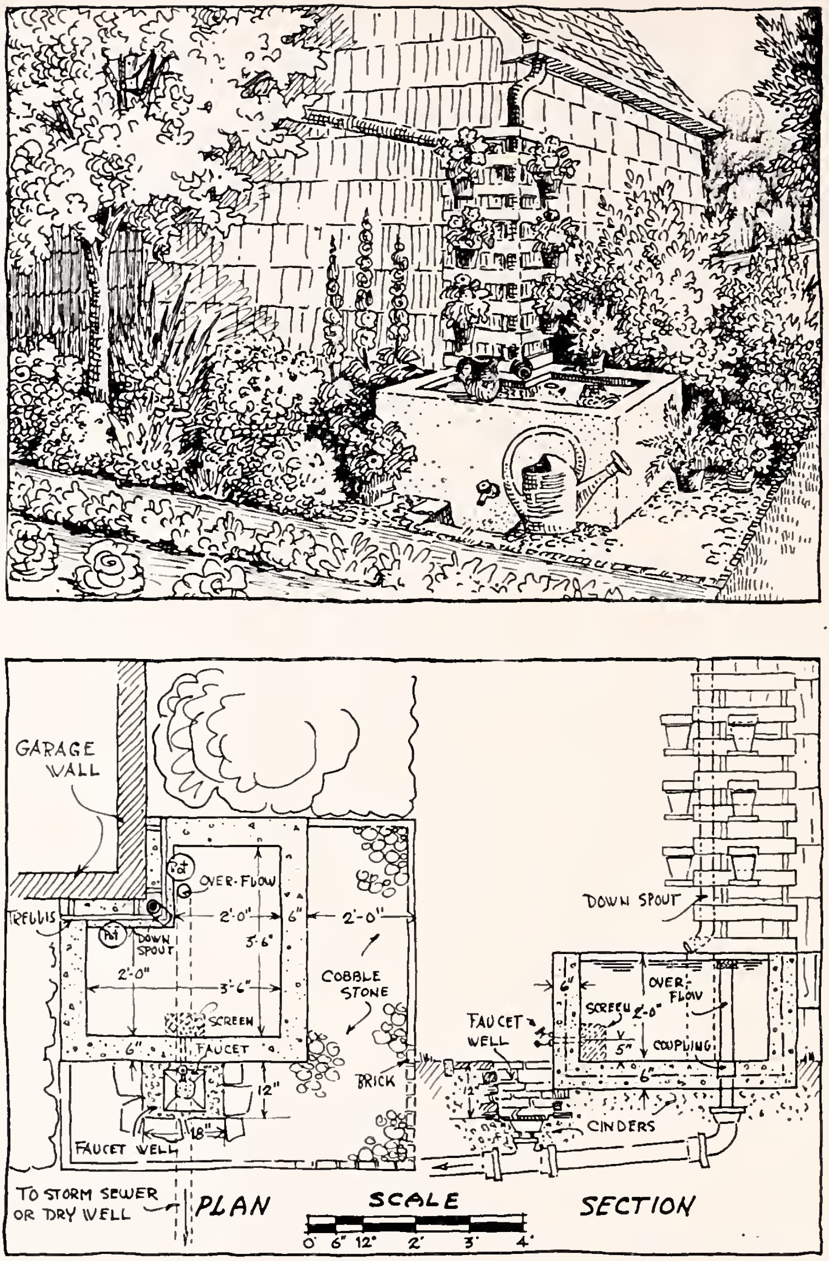
The flat **mirror or reflecting pool** should have very little planting near it and that planting of a form or color that throws interesting shadows and reflections into the water. Too much planting around the pool will take away from its mirror quality and actually make it seem infinitely smaller. The coping or top of a mirror pool should be as flat as possible with only an occasional accent of planting. Most geometrically shaped pools gain greatly in charm if the entire surface of the water is visible from some little distance. The mistake is frequently made of trying to cover the concrete rim of a pool with some kind of vine or solid planting. Such an encirclement usually results in the pool's looking crowded as the ivy or other ground cover gains in size, so that the pool is foreshortened and often actually considerably encroached on by the plants themselves. If a concrete pool is set in grass, beveling off the top edge so that less concrete shows is a far easier way to handle it than trying to hide a wide and ugly piece of concrete with heavy planting.

In the more **naturalistic pool** the plants near by should be those commonly associated with water. Swamp-loving shrubs like black-alder (*Ilex verticillata*), spicebush (*Lindera benzoin*), blueberry (*Vaccinium*), and swamp azalea (*Rhododendron viscosum*) may not actually have wet feet near a man-made pool. They look, however, much more at home than do common garden shrubs like spirea, lilac, and forsythia. Similarly, marsh-marigold (*Caltha palustris*), swamp and Japanese iris (*Iris versicolor* and *I. kaempferi*), some of the mint family, loosestrife (*Lysimachia*), and many of our native ferns add greatly to the water-garden feeling of even the tiniest pool.

Planting in the pool itself can vary according to the amount of sun and shade and the size of the pool. It is usually inclined to grow entirely too fast and takes a certain amount of restriction annually. To grow many of the aquatics, a depth of at least 2 feet is necessary. Some of the shallow-water plants should be submerged only 6 inches, but it is easy to set them up on concrete blocks or on an overturned tub. The catalogues of specialists in aquatic plants give full directions for each type as to receptacle, depth, and culture.

L.A. L. Lundquist R. A. Smith photo

An irregular pool with flat rocks overhanging the edge looks completely natural.



Drawings by Henry B. Aul

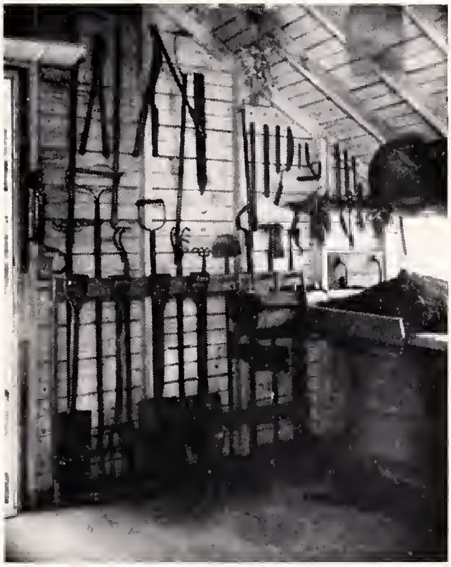
Drawing and detail of dipping cistern.

This drawing by Henry B. Aul is taken from his book "How to Build Garden Structures" and is used by permission of the author, the publisher (Sheridan House, New York), and the New York *Herald Tribune,* in which it first appeared.

STORAGE AREAS

IT often is difficult to find places to store garden tools and supplies where they are out of the way. Usually, if they are stored in the garage and without planning, suddenly there is no room for the car. They may be stored overhead (let down by pulleys) or if the garage is long, stored at the end.

Equipment should be stored by seasons. Things that are used in the winter should be stored together so that you are not annoyed in the summer months by storm windows, snow stakes and snow fence. Similarly during the winter, when it is frequently hard enough to get to the garage, tool shed or wherever you keep things, the summer tools, fertilizer spreader and lawn mower should be out of the way. Certainly everything for one season should be in one place and clearly marked. One benefit of this system is that it does enable you to take an inventory and discard objects no longer used or not worth mending. Illustrations here and on page 74 suggest ways of storing equipment.



Garden tools, stored in an orderly way and kept clean and rust-free, add to the pleasure of gardening. Coping with the many tasks that confront the gardener is simplified, too, when one has such a complete collection of tools.

Roche photo

There is not only practical value but a decorative quality to this work area that adjoins a series of herb and garden plots, each contained within a raised wooden frame.

L.A. Thomas D. Church

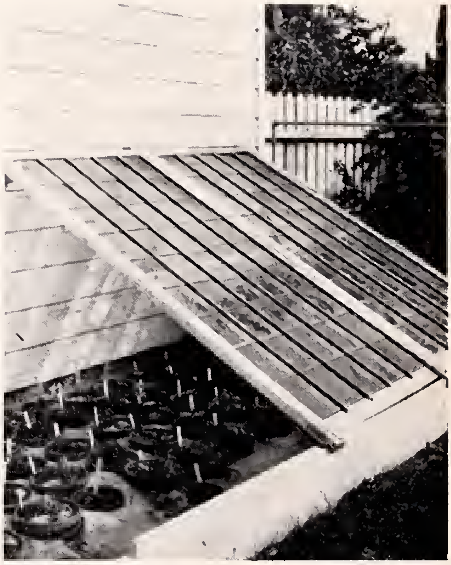
Maynard L. Parker photo

WORKING AREAS

ALMOST any property needs some kind of working area. If it is not properly planned it is likely to be both inefficient and unattractive. The amount of things that need to be in the area must depend very greatly on how much work is done at home, how large the property and what garden operations are necessary. In general there should be, in any working area, compost bins, a source of water, a working bench or table and by all means some kind of seat for the tired gardener. There must be a screen which could be a hedge or fence or tool wall. Now-a-days neither clothes lines nor clothes dryers seem to be very necessary or very popular. If they are, they may be relegated to this general gardening area where they are neither unsightly nor difficult of access.

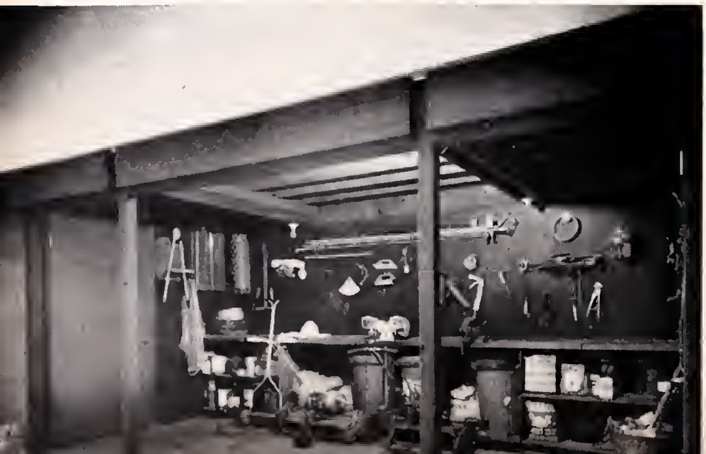
For convenience a weatherproof box to hold permanent garden labels and small stakes as well as the wax pencil used for marking will save a great deal of walking. The seat and table will provide writing space close to the garden, while ideas are fresh, and the gardener needs to sit down a while.

The work area should certainly be very close to the major tool storage. If the tools are stored in the garage it should be close to the garage. If they are stored in a special tool shed, this should be incorporated in the work area. It is wise, in planning, to make a list of the work expected to be done and the unpresentable objects that should be hidden and try to concentrate them all in one spot. After that try to find a way to screen them so the cover-up is either decorative or useful or both.



Roche photo

The nature of work areas varies with the interests of the gardener. In this instance, the chrysanthemum fancier has built a deep lean-to frame (above) in which to winter-over his stock plants.



This is a detailed close-up view of the work area pictured on page 73.

L. A. Thomas, D. Church

DESIGN AND MATERIALS FOR DRIVEWAYS

DRIVEWAYS on any property are almost sure to be one of the major expenses in original construction and sometimes also in the annual budget for upkeep. They must be planned according to the ways cars will move and maneuver and the ways they will not. In the old carriage drive days a very narrow road was sufficient. At the present time anything less than eighteen feet does not permit a car to be parked and another car to pass it. Similarly there are certain radii on which cars can turn. If this is ignored the owner is likely to find that his driveway is completely out of line or that he or his guests get angry almost every day at the difficulty of maneuvering their cars.

The accompanying diagrams illustrate the radii and the widths that are permisible in a drive and can be adapted to almost any site. The one thing to keep in mind constantly is that cars, even the compacts, are large objects and will go exactly where they have to go. If you have not planned for it you are the one, or your lawn is, that will suffer. Possibly the car fenders will, too.

The material of the driveway is dependent a great deal on the amount of traffic, the kind of property and the budget. I think few of us like the ordinary black top driveway on a private place. It is probably the most durable and practical and can be helped considerably by having another coat of oil applied over the black top and gravel or blue stone bound into the surface while

Where space is limited, landscape plantings may be set back from the street front, and a parking strip created as illustrated. Gravel paving lets water reach the tree roots.

L.A. Thomas D. Church *Fred Lyon photo*

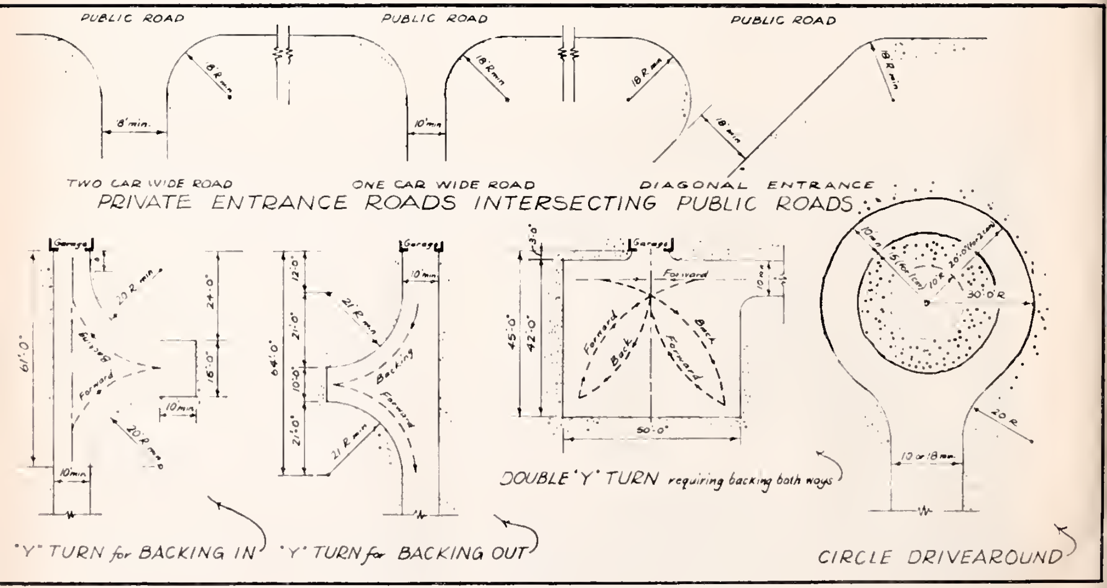
the oil is hot. This coat will have to be renewed every four or five years but does make it look more like a driveway on a private place instead of on a public square. Where the traffic is light and the weather is kind an ordinary gravel or dirt driveway will probably be completely sufficient. This is particularly true on summer places where the road can be raked in the spring and will not have winter-made ruts or wash in it. Concrete driveways for the most part are cold and inclined to be ugly. They also radiate a tremendous amount of heat, are expensive and if they once start going to pieces are extremely expensive to replace or repair.

Driveways paved with granite blocks or brick or local stone are probably the most attractive of all. Except in very mild climates, however, they do require a concrete base and usually prove to be very expensive. It may be worth the cost if the driveway is very prominent or impossible to hide. In that case they must be designed to be part of the general landscape and counted into the initial cost of the house and grounds. This kind of driveway can often double as a terrace or a place for the children to play or for numerous other purposes but it must be carefully designed to fit the property and the cost apportioned to the total value.

If the driveway or court can have a curb it will save a great deal of wear and tear on the lawn and make the whole place look much tidier. This curb may be of steel made especially for that purpose, of granite blocks or occasionally of wood, creosoted to withstand the weather. The only objection to the steel curbing is that if cars bump into it it will dent. In mild climates the granite blocks or the wood can be put in place without any sort of foundation. In colder climates the blocks must certainly have a concrete foundation which adds greatly to their expense. Otherwise they will heave and they are too difficult to put back into place. Bricks are usually not satisfactory. They are all too likely to crumble or to snap off at the driveway level. No matter what sort of curb is used it should be flush with the lawn alongside so that the lawn mower can run on it and little hand trimming is necessary.

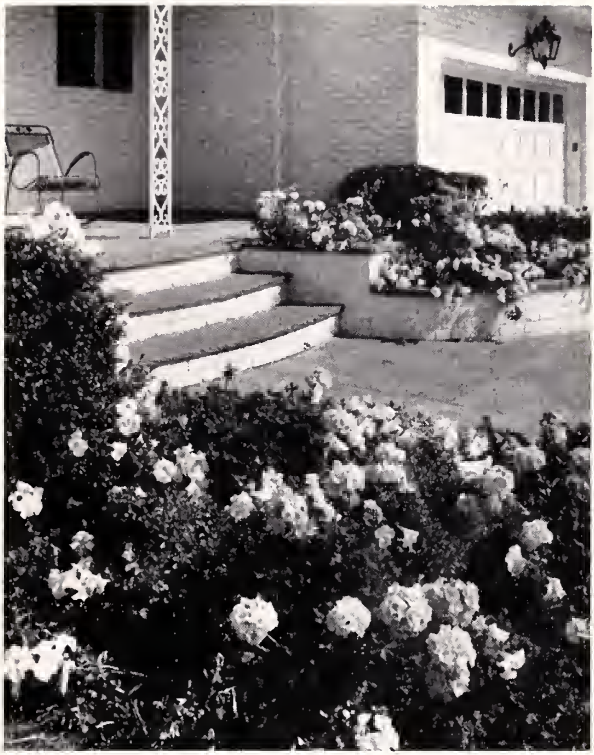
Typical details of driveways and turnarounds.

L. A. Mary Deputy Cattell



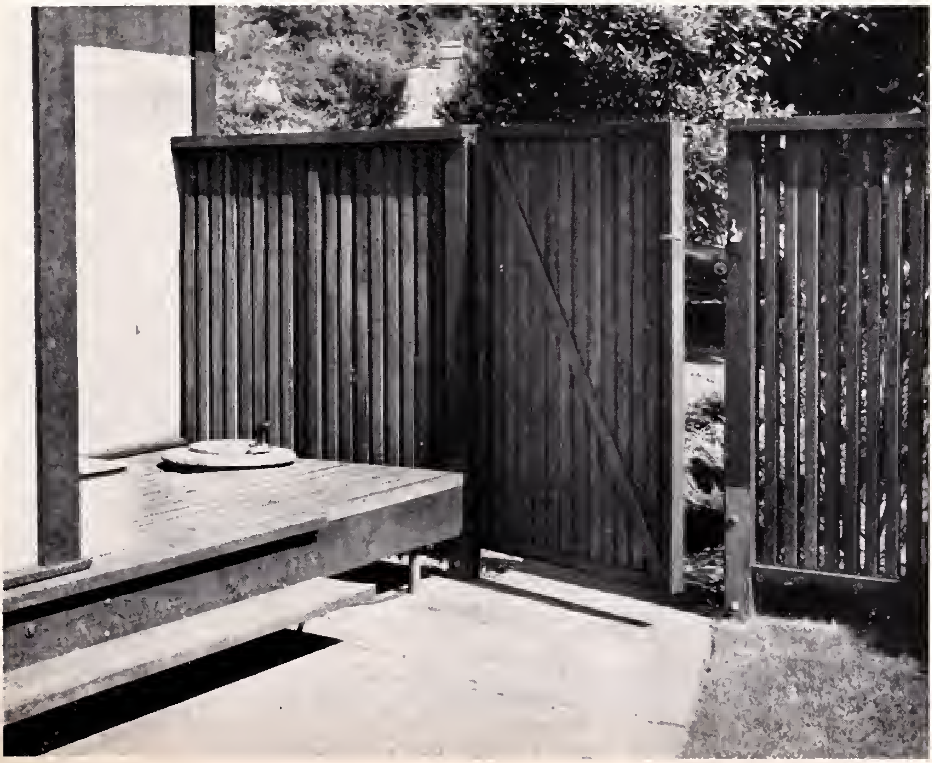
Raised planter beds, filled with evergreens and flowers, help embellish the walk and steps leading to the front door of the house from the driveway.

Gottscho-Schleisner photo



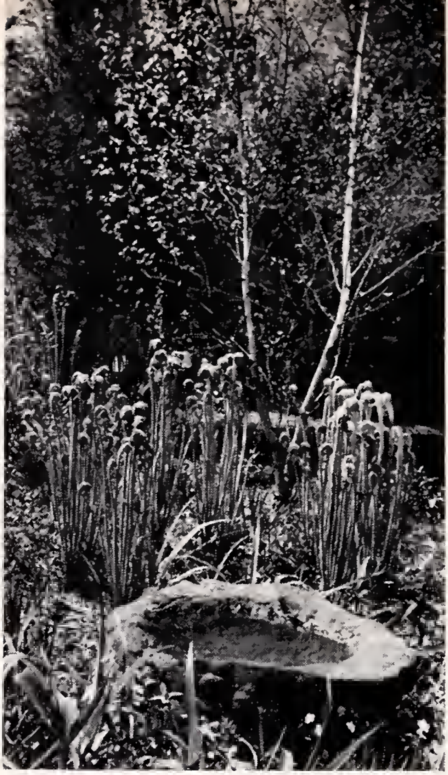
Service area at the rear of the house is screened from entrance drive by redwood fence. Garbage can outside kitchen door is sunk in raised deck.

Jeanette Grossman photo



STONE IN THE GARDEN

THERE is an Oriental philosophy that the chief purpose of having a garden is to bring Nature within easy reach, to remind man that he is a part of Nature and dwells in its presence. One of the most important features of an Oriental garden are natural rocks. The Chinese regard them as the "bones of the earth," the "skeleton of Nature." They prefer rocks which have been battered by the elements through the centuries, and left in rugged shapes. The Chinese esteem these ornamental rocks and think of them as beautiful pieces of sculpture. However, the rocks are more than mere ornaments, for they also provide a natural setting for plants. To carry this philosophy on to Japan, one can say that in Japanese gardens stones are looked upon as being more important than trees.



Gottscho-Schleisner photo

Water basin carved in large stone.

Scene in the Japanese hill-and-pond garden at the Brooklyn Botanic Garden, showing artfully placed stepping stones, slightly arched bridge and adjacent plantings.

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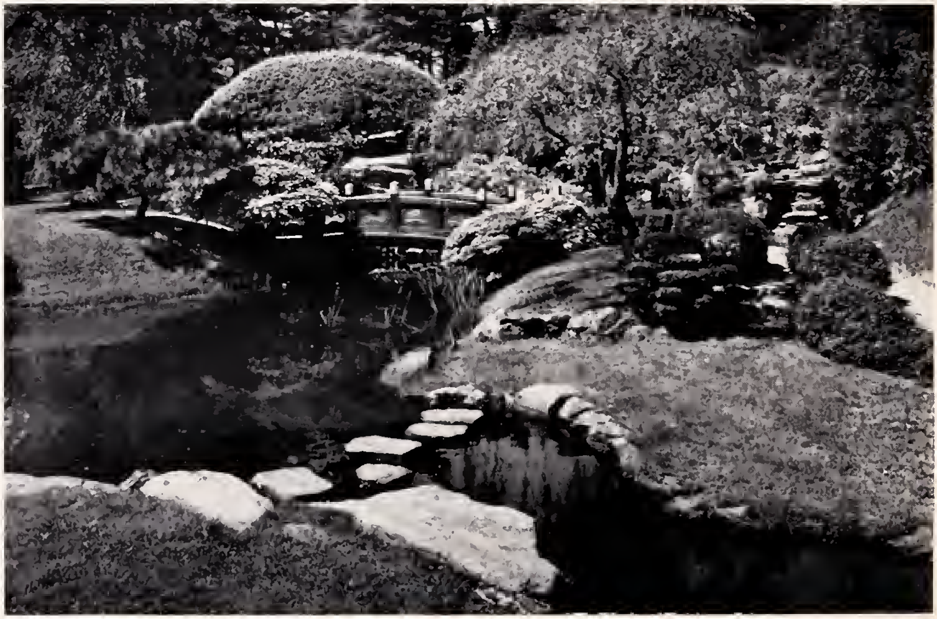
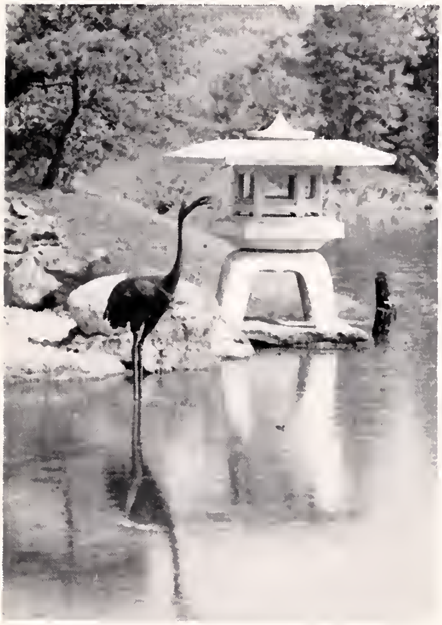


Note:
For a fuller treatment of typical structures and accessories to be found in Japanese gardens, see the Brooklyn Botanic Garden Handbook on Japanese Gardens and Miniature Landscapes.

LANTERNS CARVED IN STONE



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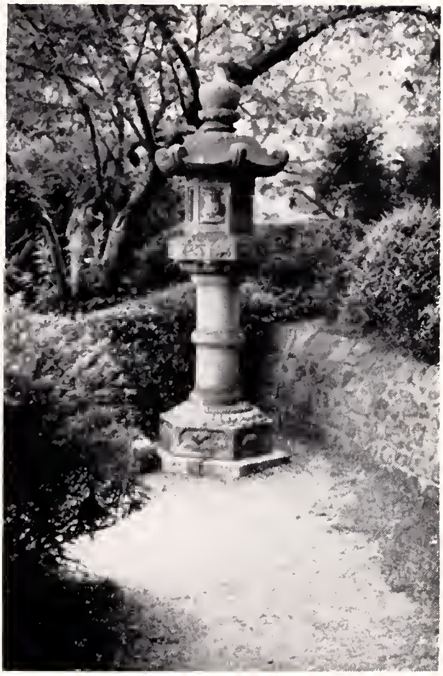
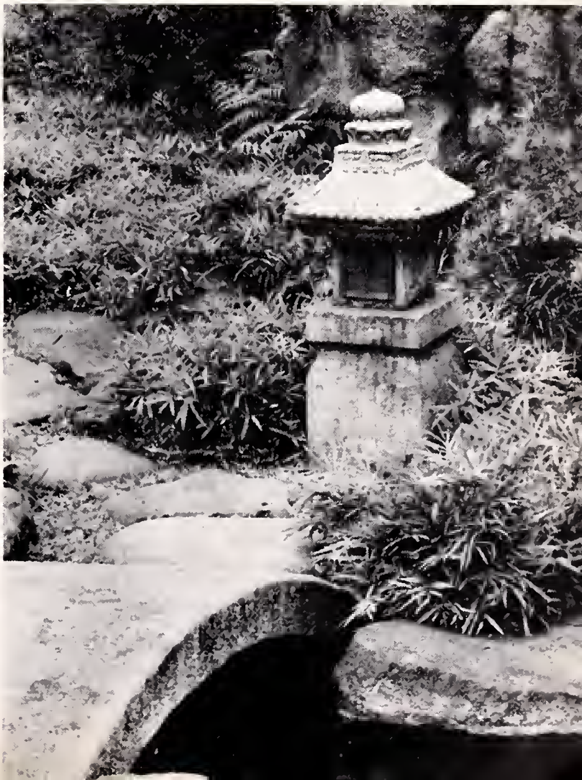


Welch photo

Broad-roofed Snow View (*Yukimi*) Lantern, so-called because it gives a charming effect to the winter landscape when laden with snow. Nearby crane is of bronze. (top left)

Kasuga type lantern, so termed from the hundreds of this type at Kasuga Temple, in the ancient Japanese capital of Nara. On the six facets under the fire box are the twelve signs of the Zodiac. (top right)



Decorative low lantern beyond arched stone bridge. Note restraint in plantings.

Jeannette Grossman photo

Buhle photo

This group of rocks, surrounded by a bed of crushed stone (ripple-raked to simulate the sea), and framed by the low roofed-wall, is in the Brooklyn Botanic Garden's replica of the famous five-centuries-old Ryoanji Temple Stone Garden (of Kyoto, Japan).

A naturalistic rock garden with pools and falls.

Harold Haliday Costain
Frederick Leubuscher, L. A.

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DYE PLANTS AND DYEING—*a handbook*

Autumn
1964

Coloring
Yarns and Textiles
with Dyes from
Plants
Basic Directions

Recipes from
Many Countries

Culture of
Dye Plants

Historical
Background

NEW SERIES
ol. 20 No. 3

AMONG THE CONTRIBUTORS

The Duke of Abercorn, Barons Court, County Tyrone, Northern Ireland. Trustee of Ulster Folk Museum, Belfast.

Kay (Kathryn T.) Boydston, Niles, Michigan; co-leader in a home-dyeing project of the local Handweavers' Guild.

Rose T. Briggs, Curator, Plymouth Antiquarian Society, at Harlow Old Fort House, Plymouth, Massachusetts, a colonial dwelling turned into a museum where the crafts of early America are demonstrated.

Harriet S. Buchheister (Mrs. Carl W.), enjoys experimenting with natural dyes. (Mr. Buchheister is President of the National Audubon Society.)

Emma Conley (the late) wrote the first edition of *Vegetable Dyeing*, a handbook published by and used at the Penland School of Handicrafts, Penland, North Carolina.

Mary Frances Davidson (Mrs.), author and publisher of *The Dye-Pot*, and director of the Shuttlecraft Shop, Middlesboro, Kentucky.

Sidney M. Edelstein, President of the Dexter Chemical Corporation in New York. Collector of books on dyeing and bleaching. Author of many articles on these subjects (published in *The Dyestuff Reporter*).

Emily W. Emmart (Mrs. Charles K. Trueblood), translator and editor of the English language version of *The Badianus Manuscript*, an Aztec herbal of 1552. Illustrated in color. 341 pages. Published by The Johns Hopkins Press, Baltimore, 1940. Mrs. Trueblood is on the staff of the National Institutes of Health, Bethesda, Maryland.

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Nine Hellig (Mrs.), weaver and dyer of Johannesburg, South Africa.

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Sue Johnson (Mrs. George R.), Piedmont, California, is an amateur dyer who cards and spins the wool she uses.

Akira Kamazaki, Japanese author who spent thirty years in search of ancient dyeing methods and in experimenting with them, in preparation for a monograph on "Kusakizome" or dyeing with plants.

Douglas Leechman, Victoria, British Columbia. Research Associate at the Lexicographical Centre of the University of Victoria and producer of documentary motion pictures. Author of *Vegetable Dyes* (Webb Publishing Company, St. Paul, Minnesota, 1945); also other books, many technical papers and magazine articles.

Meta Lewis (Mrs.), Evanston, Illinois, formerly of Penland, North Carolina. Editor of the revised edition of Mrs. Emma Conley's *Vegetable Dyeing*.

Dorothy B. Luke, Bristol, England. Handweaver, dyer, and breeder of Samoyed dogs.

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(*Continued inside back cover*)

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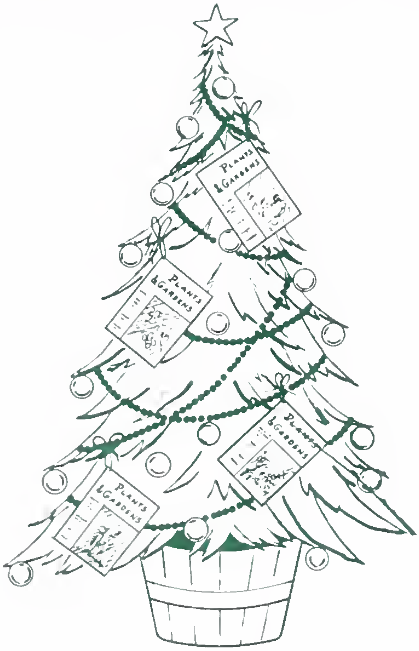

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DYE PLANTS AND DYEING

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AUTUMN 1964

This Handbook on natural plant dyes and how to use them has many objectives, not the least of which is to help in the revival of an ancient craft. For thousands of years, and up until about a century ago, the color of fabrics, whether clothes, rugs or tapestries, came chiefly from the crude juices of plants. Whoever made the first discovery—or was it an "invention"?—we shall never know. What we do know is that the use of the indigo plant (for dyeing fabrics blue) dates beyond 3000 B.C. History also tells us that it was probably a thousand years later (2000 B.C.) before man knew how to combine other substances in the dyeing process to make the colors "fast." This later discovery, now known as mordanting, helped for at least 4,000 years to give the world colored fabrics that were surprisingly resistant to fading if exposed to water or sunlight. But more important, when they did fade, whether from sheer age or from exposure to light, the colors largely kept their charm and proper interrelationships.

With the discovery of aniline dyes about a century ago, and the development of scientific methods generally, exact colors became reproducible. Thus the skill and craftsmanship of the individual were lost to mass production. Except for occasional individual craftsmen, the ancient art is no longer generally known or practiced in advanced nations. Yet it is an art that belongs in an important way to the plantsman—the gardener and the horticulturist, who wants a personal experience in transferring the pigments of the landscape to the fabrics of home and wardrobe.

Modern dyes are produced in great factories but what greater factory is there than Nature herself? Plants are indeed living factories that produce food and fiber, lumber, antibiotics, and scores of substances as yet little understood by the chemist. Natural dyes come from many parts of plants—roots, leaves, bark, flowers and fruits. Chemical Engineer George Cranch, whose avocations include dyeing and weaving, has written as follows in **HANDWEAVER & CRAFTSMAN**: "Now you have started. You look up old formulas. You see old tapestries with new eyes. You try other flowers, barberry bush trimmings, privet, pokeweed, autumn leaves, blueberries. Some work, some don't. The landscape changes in meaning. This field of goldenrod is now a mine of dye. That sneezy ragweed seems to have a lime-green color (it does on wool). . . . You sense nature in a new way; new hues, new smells, a new intimacy."

Guest Editor Schetky, her invited authors and members of our Editorial Committee have pooled their ideas, knowledge and resources to bring this hundred-page book into being. Warm responses to inquiries in other countries have given us a feeling of great friendship for people in many parts of the world (see p. 38). Their dyeing formulas, including how-to-do-it recipes from 18 different countries, are given here for all who have the urge to try them. Thousands of hand-knitted natural-plant-dyed sweaters with new colors should spring from this Handbook, not to mention fabrics. Of special significance is the relevance of dye plants to ethnological studies.

There are sources of supply for those who want to purchase the natural dyestuffs (p. 32), but let it be said here for those who want to collect or grow their own, that dye plants are not fussy—they are at home in almost any soil and many climates.

Sincerely yours,

George S. Avery, jr.

Director

The New York Unit, Inc., of the Herb Society of America has, by gift, made possible all color and other illustrations in this Handbook.

THE AGELESS ART OF DYEING

EthelJane McD. Schetky

MANY of us have as a treasured heirloom a hand-woven coverlet, the yarns home-dyed, or an old hand-hooked rug, its colors mellow with age but beautiful. Others admire such treasures in museums.

Always the same question is asked: "What did our ancestors use for dyes, and how did they know how to achieve these beautiful tones?"

The answer takes us back many centuries, for some of the dye plants used by our immediate ancestors were known to the ancient Greeks and Romans. We of today can color yarns and textiles with dye prepared from these same plants and animals, and we can set the colors just as our forebears did—and as the Mediterranean peoples did two thousand years and more ago. Dyeing with natural products is an ageless art. It is, in fact, a prehistoric craft, though the prehistoric dyes were merely fugitive stains from fruits, flowers and barks.

Animal Dyes of the Ancients

The first dye of interest is purple. Evidence of its antiquity is supplied in the fragments of purple-trimmed robes found in excavations of Grecian tombs. The ancient Phoenician town of Tyre is the accepted home of purple dyeing from Mediterranean shellfish of the genera *Purpura* and *Murex*. These are whelks, both kinds with long spiral shells greatly enlarged at the open end. The dye was extracted from the mucous gland adjacent to the respiratory cavity. It possessed fastness and brilliance of color, but was very costly. The Phoenicians, who were master shipbuilders and the most skillful sailors of antiquity, searched for these shellfish on every coast available to them. Wherever they found them in abundance, they established trading stations and dye works. Because of the great demand for the purple color, honey and orseille (*Roccella*), a lichen growing on rocks near the sea, were often used to dilute it. A Greek work of the third century A.D., now in a library in Stockholm, contains many recipes for imitating genuine purple.

We know of such things in large part from the first-century writings of two men whose works remained the principal sources of scientific knowledge for several centuries. One was Dioscorides, the Greek physician, whose work is still known in Latin translation as "De Materia Medica"; the other was Pliny the Elder, the Roman naturalist, author of "Historia Naturalis." Later, the rare and beautiful manuscripts of medieval monks recorded the culture and use of dye plants.

Pliny describes the complicated preparation of the various shellfish, which gave shades of red, blue and violet as well as rich purple. The wool to be dyed, he states, was treated first with soapwort (*Saponaria officinalis*), oxgall or alum.

Another ancient animal dye is kermes, which comes from the dried bodies of the females of a species of shield louse or scale insect (*Kermes ilicis*), which lives on two Mediterranean trees, the kermes oak (*Quercus coccifera*) and the holm oak (*Quercus ilex*). Its use was first recorded in 1727 B.C.; its color, a beautiful red. Wool, silk and leather could be dyed with kermes. Alum and urine were used in preparing the dye bath. In Islam the scarlet fez and in Greece a cap of the same color were both dyed entirely with kermes. Only those in possession of the prescribed color could manufacture these standard articles of dress.

In Greece and her colonies, near the beginning of the Christian era, the dyer's craft was widespread. While natural-colored wool was used for everyday wear, the prosperity of the period, the people's love of beauty, and the influence of oriental luxury all augmented the demand for color. Workshops increased rapidly. Dyers strove to achieve colors fast to light and water.

Robertson

The kermes oak (*Quercus coccifera*) is one of the host plants for a scale insect (*Kermes ilicis*) which was a source of red dye for more than 3,000 years.

Early Records of Dye Plants

Dioscorides describes the dye plants of the ancient world: madder (*Rubia tinctorum*) for red, through the years the most enduring red dye from a plant; saffron (*Crocus sativus*) and weld (*Reseda luteola*) for yellow; woad (*Isatis tinctoria*) for blue. The bark of oak, outer shells of fresh walnuts, branches of broom, pomegranate flowers, dyer's bugloss (*Alkanna or Anchusa tinctoria*) were among others used. Gallnuts, woody swellings caused by attacks of gallflies, presumably on the Lusitanian oak (*Quercus lusitanica*) often provided both a dye and a mordant. They are known to be high in tannic acid.

From descriptions of both Dioscorides and Pliny, it is quite evident that indigo from the Orient was already known in the Mediterranean region. In fact, in 450 B.C. Herodotus described the way in which indigo was being used.

Simple names of colors are seldom found in classical languages. Dyers harmonized colors with some analogy of nature. Ovid, advising women on colors for their clothing in his "Art of Love," speaks of the pure blue of the cloudless sky, the yellow of saffron, the green of Paphian myrtle (from Paphos, ancient city of Cyprus), the darker green of the oak, the almond tree, the gray of the crane, the amethyst.

Dyes and techniques of the Romans and Greeks were undoubtedly the same. Excavations at Pompeii show how complete the dyers' shops were. The perfection attained by these early people with their primitive equipment is scarcely outdone by present-day methods.

Alum, which generally occurs as an earthy deposit, was part of the dyeing process in the ancient world as it is today. Later, common salt and cream of tartar were also used as mordants. Two sources of alum, one of them still in use in the 20th century, are known to have existed in Turkey 500 years ago. From ports in Asia Minor this alum was taken to Europe for the dye-trade. Sources were also developed in Spain in the 16th century and large amounts were exported via Antwerp to Holland, France and Germany.

Dyes for Leather Goods

Skins and dressed hides of sheep, goats, hyenas, bison and deer led to the devel-

The thick red skin of the pomegranate (*Punica granatum*) is both ancient and modern as a source of tannin and dye, especially for leather. Yellow, brown, and violet blue are obtainable on cloth with different mordants.

opment of another craft, the dyeing of leather. The ancients were masters in dyeing leather, using the bark of the date plum (*Diospyros lotos,* a botanical relative of the American persimmon tree) when they could obtain it; also the bark of barberry, pine and alder and roots of barberry; as well as madder, kermes, ivy and bluestone or vitriol.

In Egypt, vegetable dyes were used exclusively for leather. Among them were safflower, woad and roots of barberry. The Moors introduced into Spain the method of tanning leather with the rind of pomegranate (*Punica granatum*) and brought the fruits to Cordova for the fine leather produced there.

Early Trade Between Europe and Asia

Excavations have produced artifacts to prove that commerce between China and the Mediterranean world existed long before the era of recorded history. Caravans or camel-trains crossed the Gobi Desert for centuries. In "The Syrian Desert, Caravans, Travel and Exploration," (Macmillan, New York, 1938), Christina Phelps Grant tells how camels, often 50 in a string, would be fastened together, the leader gaily decorated with colored yarns and beads. Often several strings, amounting to several thousand, traveled in a group. Homing pigeons relayed their progress from stations every 50 miles. Great quantities of goods were thus transported to the markets of the Mediterranean.

One route led to Baghdad, a city of wealth and grandeur, then to Damascus, to Jerusalem and to Cairo. A second route went from Damascus to Mosul (which gave its name to muslin, just as damask is derived from Damascus), then to the Black Sea in order to reach Byzantium (now Istanbul). This already well-established city became a great reservoir for trade goods from the East, including dyestuffs, raw materials, jewels, spices, incense and costly articles for the churches.

Such trade continued. By the eighth century, merchants from every oriental city had quarters in Damascus. Constantinople (the former Byzantium) was even better able to link the business interests of the East and West. By 1162, the records show that 1200 merchants from Italy alone were located in that city.

Venice, being in a strategic location for both overland and sea trade, became the principal city for importing dyestuffs from the East. Trade routes over the Alps reached the large commercial cities of southern Germany, and a fleet of ships sailing around Spain and France carried goods to Flanders, Southampton and London. Thriving dye-trades were also carried on in the Mediterranean cities of Florence, Pisa and Genoa. For many years Genoa had a monopoly on the alum trade.

European dyers, already flourishing in the 10th century, reached their height in the 13th century. Their fine craftsmanship was due largely to the guilds, which were vigilant in maintaining a high standard of quality.

Marco Polo, the Venetian traveler of the 13th and early 14th centuries, brought back from China information on sapan (*Caesalpinia sappan*) as a red dyewood. This had been the first species of brazilwood to be known in Europe, and it was already in use there. (Other species were later discovered to have been long in use in South America.) He also reported on the preparation of indigo, a dye already known in Europe, though not yet used extensively, partly because of its high price.

Dye-goods at Medieval Fairs

As towns grew, European trade increased via the passes through the Alps, and exchange of goods developed through large fairs. Merchants and travelers from the North were attracted to the Italian towns. The six famous fairs of Champagne in northeastern France were organized into a continuous clearing house for all of Europe. Dyes were among the important products traded. While oriental dyes were not unknown, the principal coloring matters were from native plants, especially woad, which supplied shades of blue. Colors available from other

Courtesy of the Borough of Saffron Walden

The crest of Saffron Walden in Essex, England, where the saffron crocus (*C. sativus*) was extensively grown for the medieval dye trade. The original shows this crocus in the full color of its purple flowers with the "golden" (orange) stigmas that provide the yellow coloring.

plants were russet and other reddish tones, also orange and green. White, brown and gray could be had from the natural wool.

Documents of 1361 tell of dyers going to the fair at Geneva to buy saffron, woad, vitriol, gallnuts, tartar and alum. By the 15th century, Geneva had become an international center with French fabrics and luxury goods available.

Commerce in dyestuffs expanded at the Basle fair, which also became a center of trade. Tariff lists in 1400 include saffron, madder, indigo from Baghdad, kermes, brazilwood and orseille. Alum was bought in great quantities. Basle became a medieval commercial and manufacturing town. Water power was used for pounding some of the dye materials, notably saffron, gallnuts and brazilwood. The Merchants Guild called its guild room "The Saffron" and used the saffron crocus (*C. sativus*) in its coat of arms. It is also found in the coat of arms of Florence and of the town of Saffron Walden in Essex, England. For a short time the saffron crocus was grown in Basle, because of its commercial value.

The Frankfort fairs, situated in the heart of Europe, became a central market for the then-known world. In the mid-13th century much of the trade was in luxury goods, spices from the East, costly silks, wool and linen, and also dyestuffs, which were in great demand when wool weaving became a major industry.

As London and Antwerp grew into trade centers, the Frankfort merchants sent their own agents into those cities to supply them with spices, fats, oils, and with tanning agents and dyes, including woad, madder, dyewoods, gallnuts, alum, vitriol, sulphur and tartar.

Vasco da Gama's discovery of a sea route to Asia by way of the Cape of Good Hope in 1498 opened up the wealth of the Orient to European traders and reduced the traffic through the overland passes. Indigo and dyewoods accompanied the jewels and spices from Asia on ships, in this newest step in intercontinental commerce.

Historic Books on Dyeing

In 1429 the Venetian dyers' guild had drawn up a book on dyeing for its members' use. It contained a number of dye recipes.

But more important, in 1540, the Venetian Giovanni Ventur Rosetti* published the "Plictho de Larti de Tentori," a book containing 217 recipes for dyeing, covering all instructions for dyeing cloth, linen, cotton and silk. This book, though written in the baffling Venetian dialect of the day, remained the best source of dyeing information for 200 years.

The Craft in Different Countries

Turkey-red dyeing, long kept a secret in the Orient, reached Europe in 1747. It has not been ascertained how it was originally done. Only vegetable products

*The author's name appears in various forms. See page 99.

were used, and the many processes required a month to achieve the color.

Each medieval country or region developed dyeing in its own individal way. In Scotland in the 12th century the dyers' trade was regulated by law under David I (1124-1153). In England dyeing grew in importance in the 14th century, when English textile manufacture began to develop on a large scale.

By the 13th century an efficient and extensive textile industry had been developed in France. Dyes used there until the 18th century were saffron, woad, madder, kermes, walnut root, alder bark, oak bark, yellow-wood, gallnuts and vitriol. The French also increased the dyers' craft by developing varied dyeing techniques to achieve additional colors from the basic dyestuffs. At the end of the 16th century 220 master dyers were listed in Paris.

The great advance in dyeing methods began in France in the 18th century, when a dye chemistry based on scientific principles was developed. The increasing production of industry inspired the study of physics and chemistry to improve methods. Science replaced old methods and a scientific system developed for dyeing. Books written by scholars of that period who contributed to the advancement of dyeing are still available.

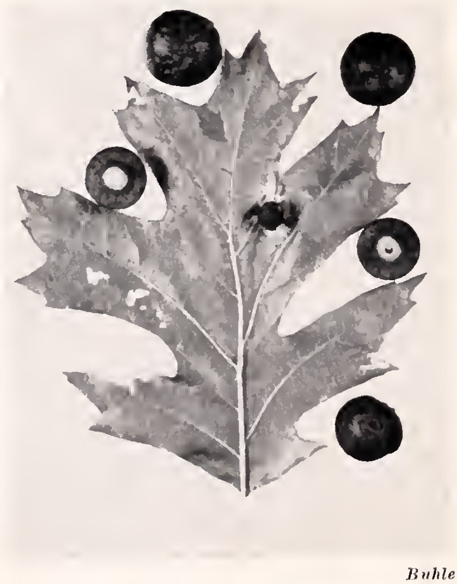
Natural dyes were universally used until the late 1800's, when aniline dyes began to appear. Commercially, these are the universal dyes of our generation. But for those interested in handcrafts and return to the dye-kettle, the beautiful soft enduring colors obtainable from natural plants will be their reward. ✦

TANNINS AND DYES FROM PLANT GALLS

GALLNUTS have been important agents for tanning, mordanting and dyeing for many centuries. As a dye source, they produce browns, grays and blacks. Until about 1940 they were used in making ink. As a mordant, they supply tannin, and it is their tannin content that also makes them valuable for the processing of leather.

Gallnuts are abnormal growths chiefly on the leaves and branches of certain kinds of trees. Those of principal interest are caused by insects. Many result from a gall wasp, the sting of which stimulates the plant cells into excessive growth. The resulting structure—oak-apple, gallnut, or whatever it may be—becomes the home of the attacker. The feeding activities of the larvae that develop within the gall release chemical stimuli which increase the tannin above that of the normal cells of the plant.

Oaks are more subject to galls than any other plant. The gallnut chiefly used in the Mediterranean region is a nutlike growth that develops on the Mediterranean oak (*Quercus lusitanica*). In Japan, when recipes for dyeing mention gallnuts, they generally refer to a hard swelling on the leaf of sumac (*Rhus javanica*).



Buhle

Oak leaf and small oak galls such as drop from trees in autumn. Sectioned galls above show insect larva at center.

Basic steps in

MORDANTING AND DYEING

FOR many centuries almost all dyes came from plants, colors from certain shellfish and insects being the principal exceptions. The beauty and warmth of the hues derived from natural dye plant materials are avaliable today to all who venture into the dye pot.

Dyeing cannot be done hurriedly. Generally two processes are involved: mordanting and dyeing. Fastness of color depends on mordanting, so this process is quite as important as the dyeing itself.

The word "mordant," derived from the Latin *mordere*, meaning to bite, refers to any substance applied for the purpose of fixing the color. It must be capable of combining chemically with the coloring matter being applied. While a few plant dyes may be used directly, the majority require a mordant for permanent color. In fact, some dyers find it expedient always to use a mordant. Thus mordanting is generally essential if the dye is to take properly and remain permanent. It also enriches the color.

Substances most frequently used in mordants are the metallic salts of alum, chrome, iron and tin. Among other agents used are acetic acid, ammonia, blue vitriol, caustic soda, lime, tannic acid and tartaric acid. Some of these will be found on household shelves in one form or another; a few can be obtained at grocery and drug stores, as shown below. Others must be sought at chemical or dye supply houses, where one-pound containers are generally the smallest available; drug stores will generally order such items for regular customers.

Characteristics of the Mordants

The Metallic Salts

Alum: Potassium aluminum sulfate, a white powder commonly known as potassium (or potash) alum. The kind of alum found in small packages at grocery stores is ammonium alum; this is less successful as a mordanting agent. An excess of alum leaves wool sticky.

Chrome: Potassium (or sodium) dichromate (also called bichromate of potash or soda). Powdery orange crystals which are sensitive to light. Available in one-pound containers. A skin irritant to some users.

Iron: Ferrous sulfate, a very pale green crystalline powder, known also as green vitriol and, especially by dyers, as copperas. It tends to harden as well as darken wool while making the color fast.

Tin: Stannous chloride crystals in the form of a white powder, available in quarter-pound containers. If too much is used, it is likely to leave wool both harsh and brittle.

Other Mordanting Agents

Acetic acid: The acid principle of vinegar, used to acidify a dye bath solution, to neutralize alkaline water, and as a solvent for coloring matter. Vinegar itself may be used.

Ammonia: Ammonium hydroxide, which is clear household ammonia (*but not the sudsy kind*).

Blue vitriol: Copper sulfate, which comes as large blue crystals. Available at drug stores.

Caustic soda: Sodium hydroxide, irregular white pellets, which can be purchased at drug and grocery stores. Destructive if dropped on clothing. Another type of caustic soda, the anhydrous form of sodium sulfite, is also used, but it must be ordered in advance by the pound.

Lime: Calcium oxide or slaked lime, a powdery white substance. A common hardware or builder's supply item, but in most drug stores in one-pound containers.

Tannic acid: A tannin, which is the astringent principle in all parts of sumac, in oak bark and in gallnuts (hard swellings on certain oaks, caused by gallflies); present also in other plants. Available at drug stores as a pale-brown powder in quarter-pound packages.

Tartaric acid: Acid potassium tartrate, a white powder, obtainable at drug stores or, as cream of tartar at grocery stores. An ancient source was the deposit from grapes in wine casks.

Equipment Needed

1. A good supply of soft water (rain water, wherever possible).
2. Dye pot or kettle of copper, stainless steel or enamelware.
3. Scales for weighing fabrics or yarns to be dyed, also plant parts used in preparing the dye. For very small quantities, letter scales are adequate.
4. Cooking thermometer.
5. Two Pyrex pitchers, pint and quart, for liquid measures.
6. Apothecary's measure for small amounts of liquid.
7. Plastic spoons for the mordanting chemicals.
8. Glass rods for stirring. (If stirrers are of wood, use a separate one for each color.)
9. Buckets for rinsing (plastic ones are easiest to handle).

General Rules for Mordanting and Dyeing Wool

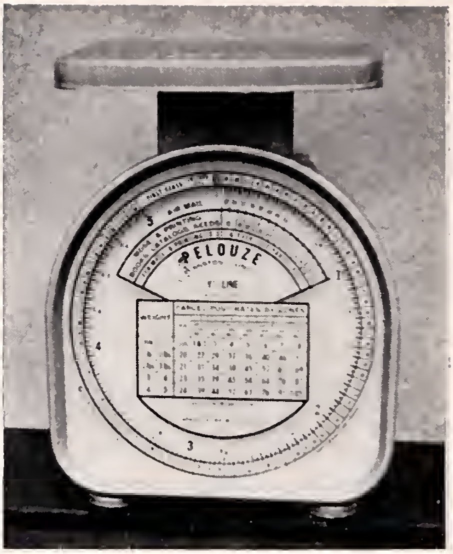
Woolen material or yarn must be thoroughly washed to free it from grease. Skeins of yarn should be tied loosely but securely with cotton cord in several places. Use mild white soap flakes (*not* a detergent) about 2 tablespoons to each gallon of warm water. If new wool is very greasy repeated washing will be necessary. Several rinsings also are essential.

If the wool is dried after washing, wet it thoroughly before mordanting by immersing in clear water; then squeeze it to remove excess water. Never twist wool when removing liquid from it; wrinkles will be all but impossible to remove.

When either mordanting or dyeing, as the water evaporates, remove the wool and add the necessary quantity of water to keep the original proportions. Return the wool to the bath to finish the process.

Directions are slightly different for each kind of mordant, but with all it is important not to let the wool boil, but simmer, not to change the temperature suddenly, and to keep the yarn or cloth completely submerged during the whole process. When a mordant, thoroughly dissolved, is to be added to a dye bath, the wool should be lifted out.

Once mordanting is finished, when done


A postal scale will serve to weigh materials to be dyed as well as the plant parts and mordants to be used.

Glass rods, like the one shown here, are recommended for stirring yarn in the dye bath. If wooden stirrers are used, a different one is needed for each color.

A non-metallic spoon, plastic for example, is best for dipping into the mordanting chemicals, such as the potassium alum shown here.

Scholtz photos

Plastic or enamel utensils are easily cleaned and are therefore most desirable for rinsing. A basin will serve for small quantities; pails are required for larger lots.

as a separate process, the bath should be cooled until the wool can be handled. Then the excess water is squeezed or pressed out by hand. While still damp the mordanted yarn can be placed loosely in a towel or bag for slow drying in a cool place. This may take four or five days. It is then ready for the dye pot.

By using different mordants, different colors may be obtained with the same plant dyes. (See, for example, the child's dyeing project on the fourth color page, also the article describing some experiments in South Africa, on page 54.)

Directions are always for one pound of dry wool.

Specific Rules for Mordanting Wool

With Alum: Prepare a water bath of 4 to 4½ gallons of soft water. Heat to hand warmth. Dissolve completely 3 ounces alum and 1 ounce cream of tartar in a small quantity of water and add to the water bath. Immerse wetted wool in the water bath, spreading and stirring it. Raise the temperature gradually (allow about one hour), but not above 212 degrees Fahrenheit, which is the boiling point. Then simmer for an hour, turning the wool from time to time with a glass rod. For very fine wool, less alum and cream of tartar should be used. Too much alum imparts a sticky feeling to wool. Otherwise rinsing is not essential.

With Chrome: Although an excellent mordant for wool, chrome is so sensitive to light that uneven dyeing may result. To prevent this, keep the wool completely submerged (a plate will hold it down) and dye immediately after mordanting. Prepare a water bath of 4 to 4½ gallons and heat to hand warmth. Add ½ ounce of chrome dissolved in half a cup or so of boiling water. Enter thoroughly wetted wool, cover vessel, bring slowly to a boil during first hour, then simmer at 200 to 212 degrees for an hour, turning it only once or twice. When cool enough to handle, rinse wool in water of similar temperature. Squeeze it gently to remove excess water, then keep it covered until the dye bath is ready.

With Iron: The most generally used method is first to simmer wool gently with the coloring matter, then remove the wool and add to the bath ½ ounce of ferrous sulfate and 1 ounce of cream of tartar. Return wool to the bath and simmer for half an hour (this is called *saddening*). By some workers, using the iron after the dye has been applied is not considered true mordanting. To keep the wool soft and the color right after using iron, rinse it very thoroughly.

With Tin: Tin (stannous chloride) is used principally with cochineal for scarlet, and for some hues of yellow and orange. Directions for its use vary widely and generally require the addition of other substances (nitric acid, cream of tartar, oxalic acid, for example), all in different amounts according to the tone desired. Follow directions with precision, noting that acids should always be added to the water, never the opposite.

Sometimes a small amount of tin, dissolved in water, is added to the dye bath toward the end of dyeing to add brilliance to the color of wool which has been mordanted with alum. When so applied, the process is called *blooming*.

Whenever tin is used, the rinsing water should be soapy.

How to Mordant Cotton and Linen

The mordanting of plant fibers such as cotton and linen requires parts of four consecutive days, the material standing overnight in the bath of the previous day. This is known as the alum-tannic acid-alum method. For each pound of dry material use:

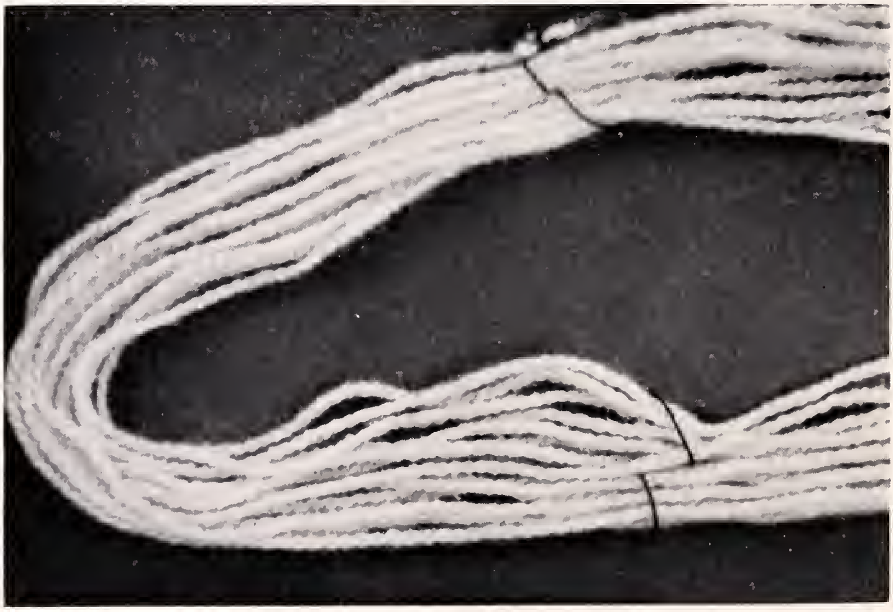
8 ounces alum (potassium alum)
2 ounces washing soda (sodium carbonate)
1 ounce tannic acid

Dissolve half the alum and half the soda in 4 to 4½ gallons of cold soft water. Wet the material in clear water, immerse it in the bath and heat gradually. Boil one hour. Then let it slowly cool and remain overnight in the bath.

Next day, squeeze the moisture from the cloth, rinse it well, then put it in a prepared bath of 4 to 4½ gallons of water with the ounce of tannic acid. Heat this bath gradually to 140 to 160 degrees and hold it at this temperature for one hour, meanwhile working the material through the bath. Cool, and let it stand overnight. Rinse lightly. Prepare a third bath of 4 to 4½ gallons of water with the remaining 4 ounces of alum and 1 ounce of soda. Repeat the first process, boiling one hour and leaving overnight. Next day, squeeze the material partly dry; rinse it before dyeing.

How to Handle Silk

On silk there is a waxy finish that needs to be removed by washing in warm, mild suds, then rinsing well before mordanting is begun. If raw silk is used it must be



Scholtz

A skein of yarn, before being placed in a kettle for washing, mordanting or dyeing, should be loosely tied in several places, preferably with cotton string, in the manner shown above.

Harvey Chase, courtesy of Penland School of Handicrafts

Dyeing as it is done at Penland. This school in the North Carolina mountains is one of the few that teaches the use of natural materials in dyeing processes. Large metal kettles set on slate are used over wood fires; wooden poles are used for stirring.

boiled with soap to remove the natural gum.

Silk in skeins must be handled carefully to prevent its matting; dip the skeins in and out of the dye instead of stirring them.

In both the mordanting and dyeing of silk the bath should not exceed a temperature of 160 degrees Fahrenheit. Otherwise procedures are the same as for wool.

General Directions for Dyeing

Preliminaries

For each pound of dry wool, use approximately 1 peck of plant material, or 1 pound of nut hulls, wood or bark. (Variances are noted in the recipes, pages 17-37.)

Provide a kettle large enough to hold at least 4 gallons of dye bath and the pound of wool, without crowding. Also have one or more tubs or pails at hand for rinsing.

Use rain water if possible. If hard water is the only kind available, it may be softened by the addition of acetic acid or vinegar. Testing with litmus paper (available, with directions, at the drug store) will indicate when the water is neutral, or soft.

To Prepare the Dye Bath

Crush, break or, with a stainless steel knife, chop the plant material, whether dried or fresh. Cover with water and let stand overnight. Boil one-half to two hours, the length of time depending on the color extracted. Strain into the dye kettle and add enough water to make 4 to 4½ gallons. Heat the bath to lukewarm and add the wetted wool.

To Prepare the Wool

The wool must be clean and moist when ready to enter the dye bath. There are three possible directions to follow:

(1) If no mordant is being used (or if it is to be applied after dyeing), wash the wool in mild soapsuds in lukewarm water and rinse it several times in water of the same temperature.

(2) If the wool has been mordanted and dried, wet it thoroughly in water of the same temperature as the dye bath, squeeze it gently.

(3) If the wool has just been mordanted with chrome, dye immediately.

The Dyeing Procedure

Place the moist wool in the lukewarm dye bath (hand warmth, or about 95 degrees). Keep it in motion, moving it back and forth (not round and round) and lifting it in and out to get the dye distributed evenly.

Heat just to the boiling point and let the kettle *simmer* (never boil) for half an hour—or longer if directions require. When water gets low, lift out the wool, add boiling water to reach the original level, stir well, and return the wool to the dye bath. The color that shows on the wet wool should be a trifle darker than the shade desired.

With dyes made from special commercial preparations derived from plants, it is important to keep the water well below the boiling point. While there is color in the water the dye bath may be used, though subsequent batches of wool will be lighter than the first.

Scholtz

The residue of plant materials needs to be strained out of the dye bath before the yarn is put in. Grapes were used in this experiment for a small quantity of dye.

Chase, courtesy Penland

Another scene from the Penland School of Handicrafts. Enamel pails are used for rinsing, each one in succession with a slightly lower temperature, the process continuing until the water is clear.

Rinsing and Drying

Have ready a tub or pail of clear water at about boiling temperature for the first rinsing. Let the second rinsing be less hot, the third a bit cooler. Continue to rinse and cool the wool by degrees until the rinse water is clear.

Remove the wool and squeeze out excess water. Roll it in a towel or other absorbent cloth, shake it out, and complete the drying by hanging it in the shade.

Scholtz and Buhle photos

Upper left: Black walnuts (*Juglans nigra*) growing on a branch. They are now ready to be picked and hulled. *Lower right:* The hulls of black walnuts may be used at once or they may be dried or kept in water for future dyeing projects. With different treatments they give black or rich tones of brown.

Above: Weld (*Reseda luteola*), dried and tied in bundles for later use.

Hints on Dyeing

Dyes prepared from plants gathered in different areas and in different seasons will vary in shade. It is therefore desirable to dye the required quantity all at once rather than to try to match tones later.

Most dye plants can be dried for future use, but some give brighter colors when used fresh. The amount varies according to the color desired.

Barks and roots require longer boiling than parts of herbaceous plants to extract the color, but the dye bath may generally be used again. Most give stronger color in the autumn, but resinous barks are stronger in the spring.

A few dyes: indigo, cochineal, saffron and madder are available at botanical supply houses. Also available are quercitron, a preparation from the inner bark of the black oak (*Quercus nigra*), sometimes sold under a trade name; Osage-orange extract, and extract of fustic or "old fustic" from the bark of *Chlorophora tinctoria,* a mulberry-like tree native to South America and the West Indies. "Young fustic," an extract from the smoke-tree (*Cotinus coggyria*), originally from the Mediterranean region, is actually of greater antiquity, but it is now little used.

When using dyes in extract form or in preparations for mordanting, confusion can be avoided (especially for a beginner) if the proper quantities of mordants for one pound of wool are measured and packed ahead of time in carefully marked envelopes. If less than a pound of wool or other material is to be dyed, it will be found practical to work in quarter-pound lots. For these, the individual packages of mordants will each contain one fourth as much.

In your dyeing activities, keep a complete record of each experience. Make notes of the amount of each mordant, of the part of the dye plant being used, as well as the quantity, and of the time allotted to each step. Always keep a labeled sample of the material dyed. ✦

An introduction to the pages that follow

35 RECIPES FOR THE HOME DYER

Using Temperate Zone plants to achieve a wide range of color

IN the recipes on the next 16 pages, follow directions given in the article immediately preceding (pages 9–15). These are summarized below. Where variations are required, they are specified in the recipes.

Plants to be used are readily available in most parts of the United States except on the Pacific Coast and perhaps in the extreme South, though neither of these areas is lacking in useful dye plants. Some of the species are garden flowers; many are native plants; and a good number are European species that have become established in the United States. Similarly, some of the American natives, as goldenrod, are known in European gardens. Of a few plants (each one noted), extracts are available commercially.

Before Dyeing Starts

Some plants are best used fresh; others are equally good when dried. In dyeing with plants (or other substances) it should be remembered that the process of mordanting, to set the color and make it fast, is as important as the dyeing itself. Customarily, it is done before dyeing. Any different procedure recommended is noted in the recipes that follow. Directions for each of the principal mordants are given on pages 9–13.

General Procedure

How to prepare the dye solution by chopping, then soaking and boiling the plant parts, and straining them out before adding their color to the dye bath, is told on pages 13 and 14. Briefly, here are the basic directions for the actual dyeing of wool:

Have wool clean and moist.

For each pound, use 4 to 4½ gallons of dye bath.

Enter wool when dye bath is lukewarm.

Heat slowly to simmering point and let simmer half an hour (longer if required), moving wool gently back and forth.

If dye bath gets low, lift wool, add hot water, mix in well, and return wool to pot.

Rinse dyed wool first in nearly boiling water, then in several waters of gradually lowered temperatures.

When rinsing water is clear, squeeze moisture out of wool and dry in shade.

Special directions for handling cotton, linen and silk are given on pages 12 and 13. When these materials will accept the same dyes as wool, this fact is mentioned in the recipes. Otherwise, the directions apply to wool, whether fleece, yarn or woven textiles.

Drawings by Eva Melady

RED

Bloodroot — **Red**

(Sanguinaria canadensis)

The rhizomes ("roots") which are used for dyeing contain a reddish-orange juice which was widely used by American Indians. A large leaf and single flower make the plant conspicuous in spring.

Mordant: Alum.

To prepare the dye: Cut 8 ounces of fresh roots into small pieces, soak an hour, then boil 30 minutes. Strain liquid into bath for dye.

To dye: Heat dye bath until lukewarm. Enter the mordanted, wetted wool. Continue heating slowly and simmer until the desired color is obtained. Rinse thoroughly and dry in shade.

Bloodroot

Ladies' Bedstraw — **Red**

(Galium verum)

The yellow-flowered European species is frequently seen as a roadside weed. Its thick roots spread out like spokes of a wheel. It is a member of the Madder Family (*Rubiaceae*).

Mordant: For light red, alum; for dull purplish red, chrome.

To prepare the dye: Chop finely one pound of roots, fresh or dried. Soak overnight, then boil one hour. Strain liquid into bath for dye.

To dye light red: When dye bath is lukewarm, enter the alum-mordanted, wetted wool. Continue heating; simmer one hour. Rinse well; dry in shade.

To dye purplish red: Immediately after mordanting with chrome, immerse the still-wet wool in the lukewarm dye bath. Increase heat slowly and simmer about an hour. Rinse thoroughly and dry in shade.

Ladies' Bedstraw

Ladies' Bedstraw — **Yellow**

(Galium verum)

The flowering tops of bedstraw produce a good yellow.

Mordant: Alum or chrome. (*Over*)

Ladies' Bedstraw (*continued*)

To prepare the dye: Use one peck of plant material, either fresh or dried and finely cut. Steep overnight in enough water to cover. Boil one hour, then strain into bath for dye.

To dye: Put mordanted, wetted wool into warm dye bath. Bring slowly to a boil and simmer one hour (longer if required for good color). Rinse in several waters of decreasing temperature and dry in shade.

Dyer's Broom

Dyer's Broom — Yellow

(Genista tinctoria)

Also known as wood-waxen and occasionally as woad-waxen, and as dyer's greenweed because of its property of making a good green when dyed over indigo. A Eurasian shrub with yellow pea-like flowers, occasionally found wild in sandy soil between Maine and Washington, D. C.; sometimes planted.

Mordant: Alum or chrome.

To prepare the dye: Boil one pound of flowering tops one hour, then strain liquid into dye bath. If tops are dried, use more than a pound.

To dye: Enter the mordanted, wetted wool when dye bath is lukewarm. Increase heat slowly and simmer one hour. Rinse well and dry in shade.

Scotch Broom

Scotch Broom — Yellow

(Cytisus scoparius)

A yellow-flowered European shrub often planted in gardens; sometimes found as an escape in sandy areas of the eastern United States. The pea-like flowers are close-set against the stiff, erect branches.

Mordant: Alum or chrome.

To prepare the dye: Soak one pound of chopped flowering branches overnight, then boil one hour. Strain liquid into bath for dye.

(*Continued on page* 19)

Scotch Broom *(continued)*

To dye: Heat dye bath until lukewarm. Enter mordanted, wetted wool; simmer one hour. Rinse; dry in shade.

On wool that has first been dyed with indigo, Scotch broom produces a good green.

Saffron

Saffron Yellow

(Crocus sativus)

For wool or silk

The three long, bright-orange stigmas of this fall-flowering crocus produced the yellow dye used by the Persians, Greeks and Romans in ancient times. An important commodity down through the Middle Ages. Available today from drug stores, botanical supply houses and Spanish grocery stores.

Mordant: Alum.

To prepare the dye: Gently boil four ounces of dried saffron half an hour. Strain liquid into bath for dye.

To dye: Immerse mordanted, wetted wool or silk in lukewarm dye bath. Simmer wool gently; steep silk at lower temperature (about 160 degrees Fahrenheit) until desired shade is obtained. Rinse carefully and dry in shade.

Safflower

Safflower, Dyer's Thistle Yellow

(Carthamus tinctorius)

Used chiefly on silk

Also called false saffron and dyer's saffron. Sold generally as American saffron in place of true saffron.

Mordant: Alum.

To prepare the dye: Bring one peck of fresh safflower blossoms to a boil and simmer one hour (use more if flowers are dried). Strain liquid into bath for dye.

To dye silk: Simmer washed silk very gently for one hour.

To dye wool: Enter mordanted, wetted wool in lukewarm dye bath and boil one hour.

YELLOW — TAN — GOLD

Agrimony **Yellow**

(Agrimonia eupatoria)

Sticklewort and church steeples are other names for this European perennial, occasionally seen in gardens and sometimes found in waste places in the northern United States. Gives a fine yellow.

Mordant: Alum or chrome.

To prepare the dye: Boil one peck of chopped leaves and stalks one hour. Strain liquid into bath for dye.

To dye: When dye bath is lukewarm, enter mordanted and wetted wool. Slowly bring to a boil and simmer one hour. Rinse well. Dry in shade.

Agrimony

Goldenrod **Yellowish tan; old gold**

(*Solidago* species)

Flowering heads of *Solidago canadensis* or almost any of the related species common to roadsides and fields can be used; pick when coming into bloom.

Mordant: For yellowish tan, alum; for old gold, chrome.

To prepare the dye: Place 1 to 1½ pecks of goldenrod flowers in enough cold water to cover; bring to a boil and boil for one hour or longer to extract their color. Strain liquid into bath for dye.

To dye yellowish tan: Enter alum mordanted, wetted wool in lukewarm dye bath. Continue heating; simmer one hour. Without rinsing, enter wool into a second bath, this one containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Keep wool moving while simmering for 15 minutes. Rinse and dry.

To dye old gold: Enter wet wool in lukewarm dye bath as soon as the chrome mordanting is finished. Simmer one hour after boiling point is reached. Rinse well; dry in shade.

Goldenrod

YELLOW — GOLD

Smartweed — Yellow; gold

(*Polygonum hydropiper*)

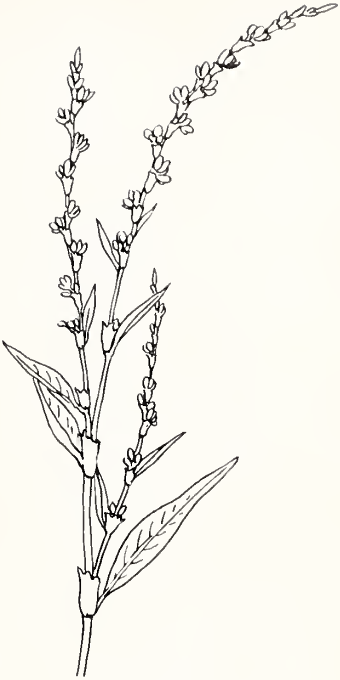
For wool, cotton, linen

Knotweed, water-pepper and red-knees are among the other names for this common weed of damp ground throughout the Northern Hemisphere. J. and R. Bronson, who wrote authoritatively on dyes and textiles in the early 18th century, considered it the most durable yellow dye for wool and more permanent than fustic on cotton. Except for the roots, the entire plant is used.

Mordant: For yellow, alum; for gold-color, chrome.

To prepare the dye: Soak one peck of the chopped plant for three or four days, then bring to a boil. Reduce temperature to about 200 degrees Fahrenheit and steep 30 minutes. Strain liquid into bath for dye.

To dye: Enter wetted, mordanted wool, bring to a boil and steep the material one hour in the dye bath. Rinse and dry. With chrome, dye immediately after mordanting. For cotton, use alum-tannic acid-alum mordant (page 12).



Smartweed

Privet — Yellow; gold

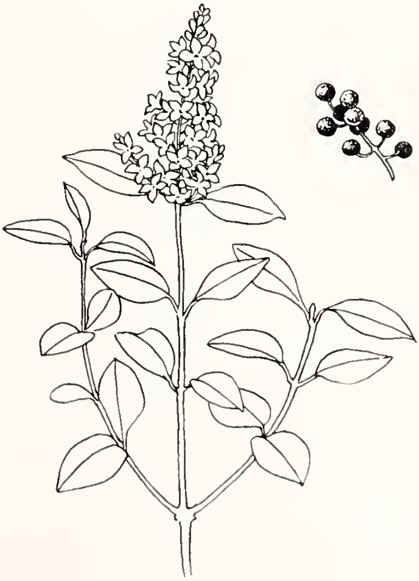
(*Ligustrum vulgare*)

Clippings from the trimming of this common hedge plant can be used for dyeing.

Mordant: For yellow, alum; for gold color, chrome.

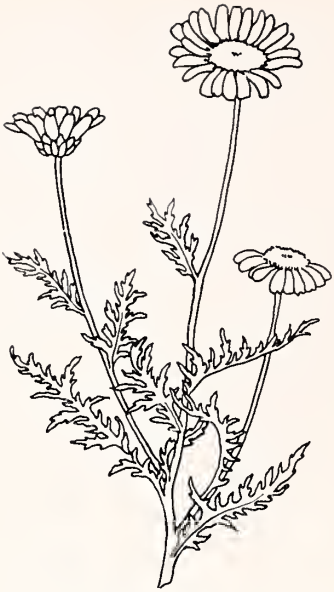
To prepare the dye: Soak overnight 1½ pecks of chopped fresh branch tips (clippings). Then heat gradually and boil 30 minutes. Strain liquid into bath for dye and cool before adding wool.

To dye: Gradually heat the mordanted, wetted wool in dye bath and simmer 45 minutes. With chrome, dye immediately after mordanting. Rinse well, as usual, and dry in shade.



Privet

YELLOW — GOLD


Golden Marguerite

Golden Marguerite — Yellow; khaki; gold

(*Anthemis tinctoria*)

A yellow-flowered, daisy-like European perennial known as dyer's chamomile, sometimes seen along roadsides in the northern United States and adjacent Canada.

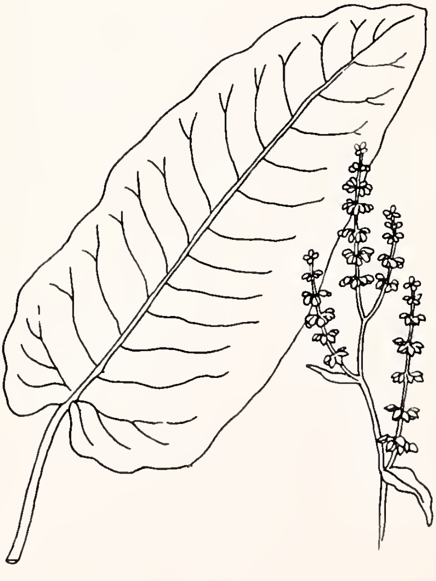
Mordant: For yellow, alum; for khaki, alum plus a second dye bath; for gold-color, chrome.

To prepare the dye: Chop one peck of flower-heads and boil 30 minutes. Strain liquid into bath for dye.

To dye yellow: Enter wetted alum-mordanted wool in cold dye bath; heat slowly and simmer one hour. Rinse well and dry in shade.

To dye khaki-color: After 30 minutes of simmering, as for yellow, enter alum-mordanted wool, without rinsing, in a second boiling bath, this one containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Simmer 10 to 15 minutes. Rinse in soapy water.

To dye gold color: Dye soon after mordanting with chrome, while wool is still wet but after it has cooled. Enter in a cold dye bath, bring to a slow boil, and simmer 30 minutes. Rinse in several clear waters of gradually reduced temperatures.


Dock

Dock — Dark yellow

(*Rumex obtusifolius*)

A tall, coarse roadside weed, with red-veined leaves at the base; naturalized from Europe and widespread.

Mordant: Alum.

To prepare the dye: Soak ½ pound chopped roots overnight. Boil one hour. Strain liquid into bath for dye.

To dye: Enter mordanted and wetted wool into lukewarm dye bath. Heat to boiling point, then simmer for one hour. Rinse well and dry in shade.

YELLOW — GOLD

Marigold Yellow; buff; old gold

(*Tagetes* varieties)

For wool or silk

Mexican plants of several species with yellow, orange, or red-and-yellow flowers, developed as garden annuals of many varieties.

Mordant: Alum.

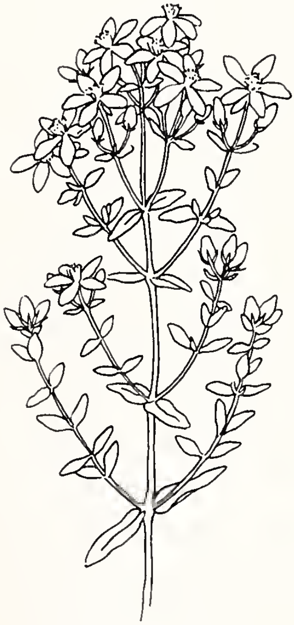
To prepare the dye: Cover one peck of fresh flower-heads with cold water. Bring to a boil and boil one hour. A few black walnut hulls boiled with the flowers will deepen the tone of yellow. If dried flower-heads are used, only ¾ peck will be needed. Strain liquid into bath for dye.

To dye wool yellow: Enter the mordanted, wetted wool in a lukewarm dye bath. Heat to the boiling point and simmer 45 minutes to one hour. Rinse, then dry in shade.

To dye wool yellowish buff: After 45 minutes in the first dye bath enter wool, without rinsing, in a second, boiling dye bath containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Simmer 15 minutes, then rinse as usual. Dry in shade.

To dye silk: Enter washed and mordanted silk in lukewarm dye bath. Heat only to 160 degrees Fahrenheit and hold at that temperature 45 minutes or slightly more. Dry the silk before rinsing it.

Marigold



St.-John's-wort

St.-John's-wort Yellow

(*Hypericum perforatum*)

A yellow-flowered European weed that has spread to dry fields and waste places throughout the eastern United States and Canada, blooming in early and mid-summer.

Mordant: Alum.

To prepare the dye: Soak one peck of plant tops overnight. Bring to a boil and simmer one hour. Strain liquid into bath for dye.

To dye: Enter mordanted and wetted wool when dye bath is lukewarm. Heat slowly to boil and simmer one hour. Rinse and dry in shade.

Queen-of-the-meadow

Lily-of-the-valley

Queen-of-the-meadow
Greenish yellow

(*Filipendula ulmaria*)

A spirea-like perennial plant from Eurasia, grown in American gardens and occasionally escaped into the wild. One of several similar plants called meadowsweet. The whole plant is cut for dyeing. Best used when coming into bloom in summer.

Mordant: Alum.

To prepare the dye: Cover one peck of plant tops with cold water. Gradually bring to a boil and boil one hour. Strain liquid into water for dye bath.

To dye: Enter mordanted, wetted wool into lukewarm dye bath. Heat gradually to boiling point and simmer one hour. Rinse thoroughly; dry in shade.

Lily-of-the-valley
Greenish yellow; gold

(*Convallaria majalis*)

Only the leaves of this spring-flowering garden plant are used for dyeing. Those gathered in spring give a pale greenish yellow; in autumn, gold.

Mordant: Chrome.

To prepare the dye: Soak one peck of chopped leaves overnight, bring slowly to a boil and boil one hour. Strain liquid into bath for dye.

To dye: Enter the wool, just mordanted and still wet, in lukewarm dye bath; heat slowly and simmer one hour. Rinse and dry in shade.

Broomsedge **Greenish yellow; brass**

(*Andropogon virginicus)*

A field and roadside grass about 3 feet tall, common throughout the eastern half of the United States. It can be dried, but is stronger in color if gathered in summer and used while fresh.

Mordant: For greenish yellow on wool, alum; for brass color, chrome. For yellow on cotton, alum-tannic acid-alum (see page 12).

(*Continued on page* 25)

GREENISH YELLOW

Broomsedge (*continued*)

To prepare the dye: Chop 3/4 peck of stalks and leaves. Boil two hours and strain liquid into bath for dye.

To dye greenish yellow: Use alum-mordanted wool. Wet it, place it in a warm dye bath, and bring slowly to the boiling point. After 30 minutes at this temperature enter wool directly, without rinsing, into a second bath, this one containing 1/6 ounce copper sulfate and 1/6 ounce acetic acid. Simmer 15 minutes. Rinse and dry in the shade.

To dye brass color: Dye the still-wet wool immediately after mordanting with chrome. After reaching the boiling point, let the kettle simmer half an hour. Then rinse the wool thoroughly and dry in shade.

For other colors on wool: Broomsedge can be used over indigo to obtain green; over madder for henna. For dyeing with indigo and madder, see pages 33-35.

To dye cotton yellow: Use alum-tannic acid-alum mordant (see page 12). Put wet cotton into warm dye bath, bring to a boil, and boil 30 minutes or longer for desired shade of yellow. Rinse and dry in shade.

Broomsedge

Nettle — Greenish yellow

(*Urtica dioica*)

This irritatingly prickly weed of wide distribution on several continents is satisfactory as a dye plant; but wear gloves when gathering it to avoid contact with its stinging hairs.

Mordant: Alum.

To prepare the dye: Chop the whole plant (except the roots) and boil one hour. Strain liquid into bath for dye.

To dye: Enter the mordanted, wetted wool when dye bath is lukewarm. Bring to a boil and simmer 30 minutes. Rinse and dry.

Nettle

Bracken

YELLOW GREEN, GRAY GREEN

Bracken, brake
Yellowish green; also gray on silk

(*Pteridium aquilinum*)

For wool or silk

A coarse fern of nearly world-wide distribution, bearing a single broad frond. Best used for dyeing at the "fiddlehead" stage in spring when the young shoots are still coiled at the tip.

Mordant: Alum or chrome.

To prepare the dye: Steep one pound of young shoots in hot water for two hours. Strain liquid into bath for dye.

To dye yellowish green: Enter mordanted, wetted material into lukewarm dye bath. If wool, simmer one hour. If silk, heat only slightly and hold at about 160 degrees Fahrenheit for one hour. Rinse and dry.

To dye silk gray: See page 32.

Bayberry **Gray green**

(*Myrica pensylvanica*)

The woody plant of the eastern United States from whose small waxy fruits bayberry candles are made.

Mordant: Alum.

To prepare the dye: Pick leaves in summer. Soak ½ pound overnight, then boil half an hour or longer to extract color. Strain liquid into bath for dye.

To dye: Enter alum-mordanted, wetted wool into dye bath, increase heat slowly, and boil 30 minutes. Rinse and dry.

Sumac **Yellowish tan; gray**

(*Rhus glabra*)

For wool or cotton

Leaves, shoots, bark and roots, as well as the fuzzy red "berries" of sumac all have dyeing properties. (For use of the leaves and shoots, see page 29). This sumac is similar to the dyers' sumac (*Rhus coriaria*) of Europe, which was imported as a dyestuff in colonial days.

Mordant: For yellowish tan, alum; for gray, ferrous sulfate in dye bath.

(*Continued on page* 27)

Bayberry

Sumac (*continued*)

To prepare the dye: Crush ½ peck of ripened (red) sumac fruits. Soak overnight, then boil 30 minutes. Strain liquid into bath for dye.

To dye yellowish tan: Enter wetted, alum-mordanted wool or cotton into dye bath. Heat to boiling point, then simmer 45 minutes. Rinse well and dry in shade.

To dye gray: No previous mordanting necessary. Add 1/6 ounce ferrous sulfate to lukewarm bath immediately after adding dye. Enter wetted wool when boiling, and simmer not more than 30 minutes. Rinse at once and dry in shade.

Sumac

Osage-orange Yellowish tan; gold

(*Maclura pomifera*)

For wool or cotton

Osage-orange, a shrubby tree of the Mulberry Family, originally from Texas and Arkansas, widely planted elsewhere as a hedge and hardy in the north. This was one of the dyes used for khaki uniforms during the First World War. An extract from the bark is available from dye supply houses. It contains the same principle as fustic.

Mordant: For yellowish tan, alum; for gold-color, chrome.

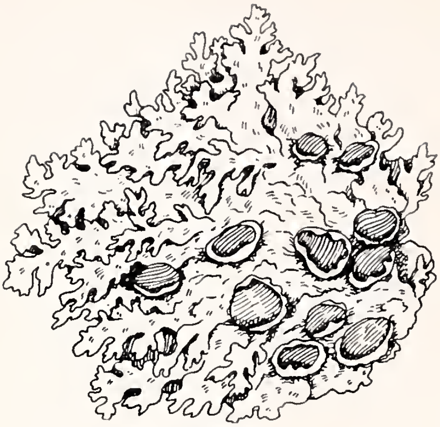
To dye yellowish tan: Dissolve ½ ounce extract in a warm dye bath. Add alum-mordanted and wetted wool; heat slowly, and simmer 30 minutes. Remove wool and, without rinsing, immerse it in a second boiling bath (again 4 to 4½ gallons of water) containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Simmer 15 minutes, moving the material slowly but constantly. Then rinse and dry.

To dye gold color: Dissolve ½ ounce extract in a warm dye bath. Enter the wet wool soon after mordanting with chrome. Heat slowly, then simmer one hour or longer, according to the depth of gold desired. Rinse and dry.

For cotton: Use alum-tannic acid-alum mordant (page 12) and follow dyeing directions given for yellowish tan.

Osage-orange

TAN



Lichen

Lichen Tan

(*Parmelia conspersa*)

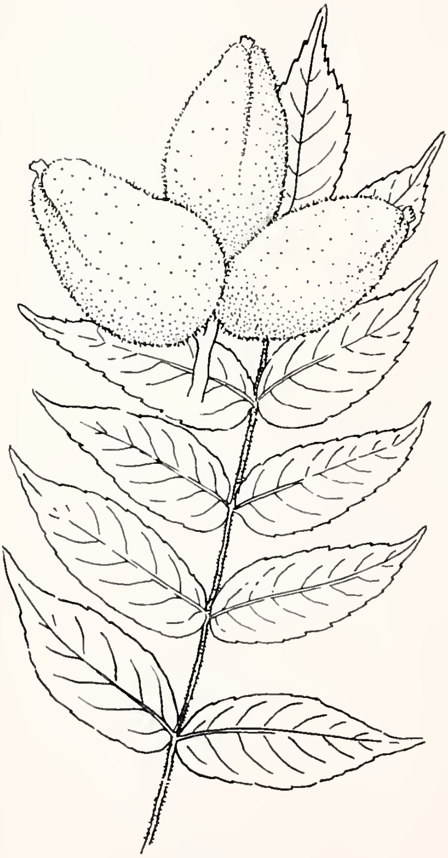
Many lichens can be used for dyeing, among them this flattish gray lichen that is common on rocks in New England and elsewhere. They are most easily cut from the rocks after rain, when they are soft. Wash them and dry them for future use. Those gathered in August give the strongest colors.

Mordant: Alum.

To prepare the dye: Soak one peck of lichens overnight. Boil one hour and strain liquid into bath for dye.

To dye yellowish tan: Enter alum-mordanted and wetted wool when dye bath is lukewarm. Continue heating to a boil, then simmer half an hour or longer. Rinse as usual and dry wool in shade.

To dye rose tan: After 30 minutes of simmering, remove wool and, without rinsing, put it into a hot bath containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Simmer 15 minutes, then rinse and dry.



Butternut

Butternut hulls Tan

(*Juglans cinerea*)

Butternuts should be gathered from the trees while the hulls are still green.

Mordant: None.

To prepare the dye: Remove the hulls by pounding them with a hammer against a flat stone. (Use rubber gloves to prevent stained hands.) When a peck has been amassed, soak the hulls overnight, then boil one hour and strain liquid into bath for dye.

To dye light tan: Wet wool and immerse it when the dye bath is lukewarm. Continue heating slowly to a boil and simmer one hour. Rinse and dry.

To dye dark tan: After 30 minutes of simmering, remove wool and, without rinsing, put it in a boiling water bath containing 1/6 ounce ferrous sulfate. Simmer 15 minutes. Rinse well and dry in shade.

To dye cotton gray: See page 32.

Sumac Tan to dark brown

(*Rhus glabra*)

For wool or cotton

Leaves and young shoots of sumac contain a large amount of tannin. Since tannic acid is a mordant, no previous mordanting is required.

To prepare the dye: Gather leaves and shoots (only the current season's growth) in late summer and dry them like hay. Before using, cut them finely, soak overnight in enough water to cover, and boil 30 minutes or more. Strain liquid into bath for dye.

To dye: Wet the material and enter into lukewarm dye bath. Heat gradually to a boil and simmer until the desired shade is obtained.

(For yellowish tan from sumac berries, see page 27.)

Black walnut Dark brown; black

(*Juglans nigra*)

One of the oldest of home dyes in North America; also widely used on other continents where black walnuts have been planted. The nuts are collected while the hulls are still green. Remove the hulls (see directions for butternut hulls, above), cover them with water, and store them away from the light until ready for use. Or, dry them at once and store for future dyeing. Best used on coarse wools.

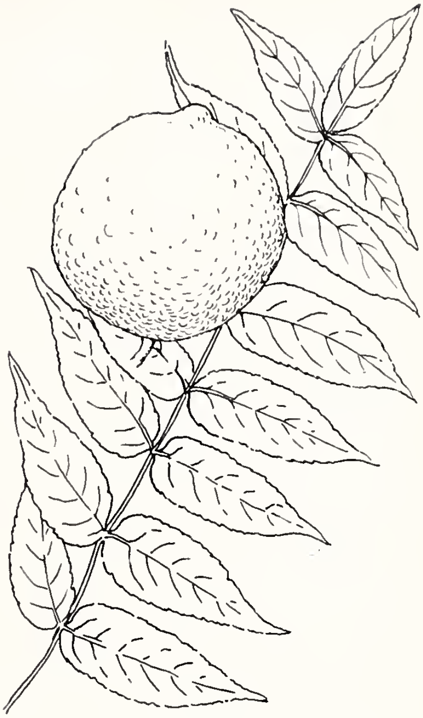
Mordant: None required, but a richer color obtained if one is used.

To prepare the dye: Soak 6 quarts of hulls overnight and boil two hours before straining liquid into bath for dye.

To dye: Immerse wetted wool when dye bath is lukewarm. Heat to boiling point and simmer one hour.

To darken the color: Add a few sumac berries and a pinch of copperas (ferrous sulfate). The dye bath can be used several times over, each time giving a slightly lighter tone.

To obtain black: Dye wool first with indigo (see page 33) to get a deep blue. Rinse wool thoroughly, then enter into dye bath of black walnut as for dark brown. Add a handful of sumac berries. Simmer one hour. Leave overnight in dye bath. If not dark enough, next day add more black walnut dye and a pinch of copperas. Heat again to boiling point and simmer until color is right. Rinse thoroughly and dry in shade.



Black Walnut

Black walnut Drab

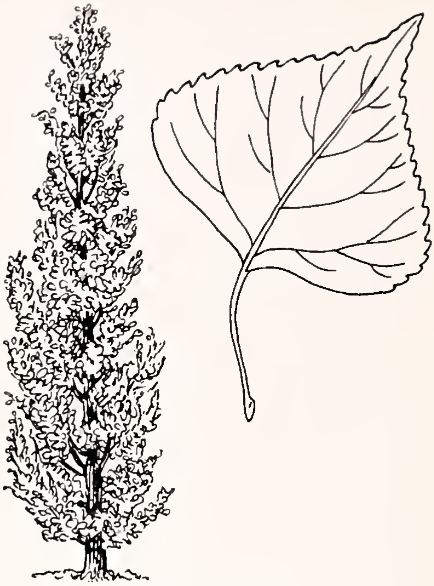
(*Juglans nigra*)

For cotton

Mordant: Alum-tannic acid-alum (p. 12).

To prepare the dye: Follow directions for dark brown on wool.

To dye: Boil cotton 45 minutes in dye bath. Rinse well and dry. For a darker shade use a second bath of boiling water containing ½ ounce ferrous sulfate. Boil 15 minutes. Rinse and dry.



Lombardy Poplar

Lombardy poplar

Lime yellow; golden brown

(*Populus nigra italica*)

The frequently planted Lombardy poplar of Europe has become naturalized in parts of the eastern United States. The leaves give distinctive colors with different mordants.

Mordant: For lime yellow, alum; for golden brown, chrome.

To prepare the dye: Chop 1½ pecks of leaves and soak overnight. Heat gradually and boil 45 minutes to an hour. Strain liquid into bath for dye.

To dye lime yellow: Enter alum-mordanted, wetted wool into lukewarm dye bath. Heat to boiling point and simmer until color is right. Rinse; dry in shade.

To dye golden brown: Soon after mordanting with chrome, enter wet wool into dye bath. Continue heating and simmer until the desired color is obtained. Rinse well and dry in shade.

Black Oak

Black Oak

Buff; gold; orange

(*Quercus velutina*)

For wool, cotton, silk

If you wish to use fresh oak bark, strip bark from the trees (preferably recently felled trees) in the spring. Remove outside and retain inner bark, which is soft. Put it in an airy place. When dry, it can easily be powdered. Since it is high in tannin, a mordant is not essential, but it is generally advantageous to use one.

Quercitron, an extract made from the powdered inner bark of black oak, is available in dye supply houses, and is easier to handle.

Mordant: For buff, alum; for gold color, chrome; for orange on silk, tin.

To dye buff: Dissolve ½ ounce extract in the dye bath. Enter alum-mordanted, wetted wool; heat slowly, and simmer 30 minutes. Remove wool and, without rinsing, immerse it in a water bath containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Simmer 15 minutes. Rinse well and dry.

(*Continued on page* 31)

Black Oak (*continued*)

To dye gold color: Dissolve ½ ounce extract in the dye bath. Enter wet wool which has just been mordanted with chrome. Heat slowly and simmer one hour. Rinse well and dry.

To dye orange on silk: For the dye bath mix 2 ounces of quercitron, 1 ounce of tin (stannous chloride) and ½ ounce oxalic acid in the usual 4 to 4½ gallons of lukewarm water. Enter the washed silk and steep for one hour. Remove silk and add to the bath 1 ounce of tin, 1 ounce oxalic acid, and 2 ounces of cochineal. Heat to 160 degrees Fahrenheit and let the silk steep in this for another hour. Dry silk before rinsing.

Coreopsis, calliopsis — Burnt orange; bright yellow

(*Coreopsis tinctoria*)

There are many species, wild and cultivated. In the South, one kind is called the dye-flower.

Mordant: For burnt orange, chrome; for bright yellow, tin and cream of tartar.

To prepare the dye: Boil 1 to 1½ pecks of fresh flower-heads 20 to 30 minutes. Strain liquid into bath for dye.

To dye burnt orange: As soon as wool has cooled after mordanting with chrome, enter it into a cool dye bath and bring to a boil at once, then slowly simmer until the color suits. Rinse and dry.

To dye bright yellow: For mordanting, dissolve ½ ounce stannous chloride and ½ ounce cream of tartar and add to 4 to 4½ gallons of warm water. Enter wetted wool and simmer half an hour, keeping the wool covered all the while.

Prepare the dye bath as for burnt orange. Enter the mordanted wool without rinsing. Bring to a boil at once and continue gently boiling until the desired color is reached. Rinse in soapy water and dry in shade.

Onion — Burnt orange; brass

(*Allium cepa*)

Only the papery brown skins of the common cooking onion are used.

Coreopsis

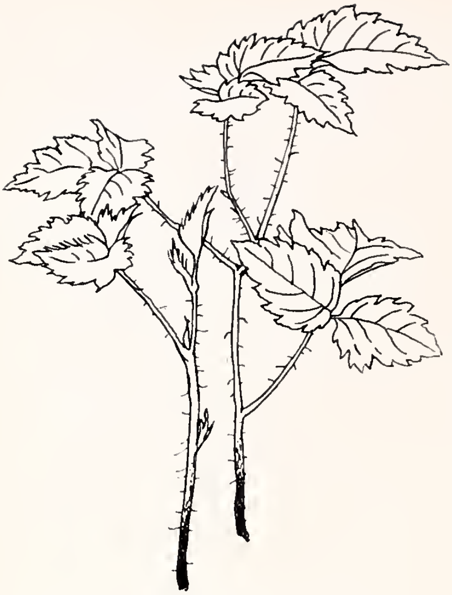
Onion

Mordant: For burnt orange, alum; for brass color, chrome.

To prepare the dye: Boil one pound of skins 30 minutes. Strain liquid into bath for dye.

To dye burnt orange: Steep alum-mordanted, wetted wool one hour in hot dye bath. Rinse and dry. To make the color more durable, dip the wool two or three times more in the dye bath, drying it after each dipping.

To dye brass-color: Immediately after mordanting with chrome, enter the still wet wool in the warm dye bath and steep until the desired tone appears. Rinse and dry.



Blackberry

Bracken, brake — Gray

(*Pteridium aquilinum*)

For silk

Mordant: Iron.

To prepare the dye: Boil one pound of fern shoots 30 minutes and strain liquid into warm dye bath. Enter washed, wet silk and steep one hour. Remove silk; cool dye bath and add one ounce ferrous sulfate and two ounces cream of tartar. Mix well; return silk to bath, heat gradually to boiling, reduce to 160 degrees Fahrenheit, and steep half an hour longer. Dry silk before rinsing.

(For bracken dyes on wool, see page 26.)

Blackberry — Light gray

(*Rubus* species)

For wool or silk

Young shoots of the common brambles of roadsides and waste places can be gathered in the spring for dyeing.

Mordant: Alum.

To prepare the dye: Boil one pound of young blackberry shoots 45 minutes. Strain liquid into bath for dye.

To dye wool: Immerse wool when dye bath is lukewarm, bring to a boil and simmer one hour. If a darker gray is wanted, lift wool out and add ½ ounce iron (ferrous sulfate) to the dye bath. Mix in well; return wool and continue simmering until the shade desired is obtained. Rinse and dry.

To dye silk: Enter washed and mordanted silk into lukewarm dye bath. Heat to about 160 degrees Fahrenheit and hold at that temperature for one hour. Dry silk before rinsing it.

Butternut hulls — Gray

(*Juglans cinerea*)

For cotton

Mordant: Alum-tannic acid-alum.

To prepare the dye: Follow directions for tan on wool (page 28).

To dye: Enter mordanted cotton into dye bath as for wool. After boiling 30 minutes, remove cotton and, without rinsing, put it in a boiling water bath containing 1/6 ounce ferrous sulfate. Boil 15 minutes. Rinse and dry. ◆

Sources of Dried Plant Parts and Other Dyestuffs

HOME craftsmen wishing to obtain commercially prepared plant dyes in small quantities will find very few distributors handling them.

Skilbeck Brothers Limited, Bagnall House, 55 & 57, Glengall Road, London, S.E. 15, England (established in 1650), lists, in addition to numerous mordants, brazilwood, cutch, fustic, galls, gambier, logwood, madder, turmeric and synthetic indigo, but only indigo in less than one-pound quantities.

Dominion Herb Distributors Inc., 136 Oneida Drive, Pointe Claire, Quebec, Canada, write that they "supply all the herbs which are used in various forms of dyeing."

Catalogues may be obtained from both dealers.

DYES OF ANCIENT USAGE

INDIGO and woad for blue, madder for red, weld for yellow, and cutch (catechu) for brown are among the oldest dye plants known to Eurasian civilizations. While aniline dyes have supplanted them for general commercial use, several of the natural plant dyes still have a limited, specialized place in the dyeing industry today. And all are of interest to home dyers who choose plants in place of manufactured powders as their source of coloring. Woad, however, is not easily handled by the amateur.

In the New World, two of the oldest dye plants are logwood and fustic, both rather small trees from the tropical Americas. Extracts from the wood of these trees (fustic for tones of yellow, logwood for various dark colors) are available today for home dyers as well as for industry.

Notes on these long-known dye plants, with directions for their use, are given here.

Indigo — Blue

(Indigofera tinctoria)

Indigo is a delicate-appearing shrub of the Legume, or Pea, Family with oval leaflets and spikes of tiny reddish-yellow flowers. Long known for the clarity and fastness of the blue that it produces, it spread in use at an early date from the East Indies throughout the ancient world.

Production of the dye depends on fermentation of the leaves. Leaf-bearing branches are cut from the plant, immersed and allowed to remain in water for the fermentation period. The paste which settles on the bottom of the vessel is processed into cakes, which must be finely ground before being used. The color develops only when the material being dyed is exposed to air. Most craftsmen purchase indigo powder ready to use.

There are several methods for obtaining a permanent blue color from indigo. Most dyers find the hydrosulfite vat most satisfactory. Directions for preparing a stock solution of dye, as given in the U.S. Department of Agriculture's Miscellaneous Publication No. 230, *Home Dyeing with Natural Dyes* by Margaret S. Furry and Bess M. Viemont, are quoted here:

> A stock solution is made up as follows:
> 4¼ ounces powdered indigo
> 3 ounces sodium hydroxide [caustic soda]
> 2¾ ounces sodium hydrosulfite
>
> Mix the powdered indigo with the sodium hydroxide which has been dissolved in water. Add water to make one gallon and heat to 120 degrees Fahrenheit. Stir well and add the sodium hydrosulfite slowly. Let stand for 30 minutes. The liquid should be clear and yellow, and a drop running on a sheet of glass should require about 25 seconds to turn blue. Extra stock solution may be kept in a stoppered bottle.

The next step: Into a quart jar of water slowly pour one-half ounce of sodium hydrosulfite. Keep the solution tightly stoppered.

To dye dark blue. Heat the dye vat to 120 degrees Fahrenheit, add one-half cup of hydrosulfite from the quart jar and let stand 30 minutes. Then add 2½ quarts of the indigo-hydrosulfite stock solution. Let stand 20 minutes before entering the wetted wool. For even dyeing, keep the dye bath between 120 and 130 degrees Fahrenheit. Keep the wool submerged, stirring it for 30 minutes. Without squeezing, hang outside for 30 minutes.

Many dips will produce darker shades, so continue with the dye vat and airing until the desired color is obtained.

When finished, rinse in a light acetic acid bath, then in hot soap suds and clear water.

The reason for the extra stock solution and the quart jar of sodium hydrosulfite solution is to restore the dye vat's contents, if necessary, to proper consistency.

If the vat turns blue, add 3 ounces from the jar of sodium hydrosulfite, stir gently and let stand 30 minutes before using. Add more indigo-hydrosulfite stock if needed.

Woad — Blue

(*Isatis tinctoria*)

When Roman invaders under Julius Caesar crossed what is now known as the English Channel in 55 B.C., they are reported to have found a race of men who stained their bodies blue. The woad plant provided the dye. Consequently, generations of Latin students and others exposed to Caesar's *Gallic War* have associated the woad plant solely with the British Isles. But this rather tall, yellow-flowered member of the Mustard Family is widely distributed in Europe and Asia, as well as in North Africa. In Egypt it was being cultivated early in the Christian era.

Today it is rarely used, for preparation of the dye is complicated. In "The Woad Plant and its Dye" (Oxford University Press, London, 1930), Jamieson B. Hurry tells how it was made during the height of commercial woad production in England (13th to 16th centuries).

The leaves were ground by enormous wooden rollers which were drawn round and round by horses, each led by a man. When reduced to a pulp, the mass was separated into heaps for draining. Next, by kneading and rolling, it was formed into balls, two handfuls in each. The balls were dried on racks from one to four weeks. The same rollers that had pulped the leaves then ground the balls to powder.

This powder was conveyed to an enclosure called a couching house, which had a stone floor, on which it was piled in a layer two or three feet deep and sprinkled with water. For nine weeks it was left to ferment, being sprinkled and turned frequently. A dark clay-like substance resulted, one-ninth of the bulk of the original leaves. This was the dye.

The medieval method of dyeing with woad was to make an aqueous solution, add alum or potash as a mordant, heat the mixture and hold for three hours. The material was then immersed, moved to and fro, and removed when the color was uniform. As with indigo, the material would not show blue when first taken out of the dye pot. The color is brought out by the oxygen of the air.

Woad was formerly used to assist the fermentation process of indigo. It is rarely available today, but by those who grow it as a garden biennial or perennial, the plant is prized for the abundance of yellow it brings to the spring scene.

Madder — Red

(*Rubia tinctorum*)

For wool, cotton, linen and silk

Madder gives the best and most enduring red dye of any plant. It is Eurasian in origin and is of ancient usage.

The several stems of the madder plant are more or less procumbent and they bear their narrow leaves in circles (whorls) at intervals, in the same manner as bedstraw (*Galium*), but larger. Also as in some kinds of bedstraw, which likewise belong to the Madder Family, the leaves are roughly prickly on their lower surfaces and margins. Minute yellow flowers occur in loose, spidery clusters above the whorls of leaves and at the tip.

After three years' growth, the long fleshy roots are dug, cleaned and dried, then ground. This is the only red dye for which hard water is recommended. If only soft water is available, add a little slaked lime (calcium hydroxide).

Mordants: Different color tones can be achieved with different mordants. For lacquer red, use alum; for garnet red, chrome.

To prepare the dye: Soak 8 ounces of powdered madder root overnight. Bring to a boil, then immediately strain through gauze into water for dye.

To dye wool lacquer red: Immerse alum-mordanted and wetted wool in lukewarm dye bath. Bring slowly to a boil during 1½ hours. Reduce heat at once to 190 degrees Fahrenheit and simmer 45 minutes. Never let the dye bath boil.

Cool to permit easy handling, then rinse. To the last rinse water add ½ ounce (two tablespoons) of mild soap flakes to each gallon to brighten the color. (Instead of the soap flakes, a handful of bran for each pound of wool in the dye bath itself will also add brightness.)

To dye wool garnet red: Immediately after mordanting with chrome, immerse the wool in the dye bath and keep it covered. Follow the same dyeing directions as for lacquer red.

To dye cotton and linen: Use alum-tannic acid-alum mordant (see page 12). Immerse wetted material in dye bath and slowly raise the temperature to 200 degrees Fahrenheit and keep it at 200 degrees for one hour. Lift yarn and add one-third ounce baking soda, return yarn and continue one-half hour at 200 degrees. Rinse as for lacquer red.

To dye silk: Mordant with alum. Prepare dye bath as above; add one ounce of bran. Immerse wet, mordanted silk, and slowly bring to a boil during one hour. Simmer 10 to 15 minutes. Follow with a bath of warm soapy water (two ounces of soap per gallon) with one teaspoon of stannous chloride added for brightening. Use rinse waters of temperatures that are gradually reduced. The final rinse is in cold water.

Weld — Yellow; old gold

(*Reseda luteola*)

For wool and silk

Weld, or dyer's mignonette, is a tall annual herb that is native throughout the Mediterranean region. It is considered to be of greater antiquity than any other yellow dye. The color derived from the plant is of great permanence. On wool this dye imparts softness to the texture.

The flowers, in themselves inconspicuous, are borne in long, very slender, erect spikes. The plant should be gathered when in full flower but before the blossoms fall. If used at once the color will be brighter, but the plant instead may be dried for future dyeing.

Mordants: For lemon yellow on wool, alum; for golden yellow, chrome; for orange, alum and tin; for yellow on silk, chrome.

To prepare the dye: Put one pound of plant material in cold water, bring to a boil and simmer two hours. Strain into bath for dye. For deeper shades of yellow, use more plant material.

To dye wool lemon yellow: Immerse alum-mordanted, wetted wool in dye bath. Let it simmer 1½ hours. For a richer color, add one ounce of powdered chalk (calcium carbonate) near the end of the period.

To dye wool golden yellow or old gold: Mordant wool with chrome and dye immediately, placing wet wool in warm dye bath and keeping it submerged. Bring to a boil, and simmer for 1½ hours.

To dye silk yellow: Wash silk and mordant it with one ounce dichromate of potash, letting it simmer, covered, one hour at a low temperature (140°). Immerse it immediately in dye bath and simmer, covered, another hour.

To dye wool orange: Madder or cochineal is added to the final dye bath. Mordant wool with alum. Wet it well before immersing it in dye bath of weld. Simmer one hour. Remove wool in order to add tin (one teaspoon of stannous chloride) to the dye bath. Stir in well; return wool, and simmer one-half hour longer. Remove wool again and place it in a separate bath containing ¼ ounce of prepared madder or cochineal. Simmer 30 to 45 minutes longer for the desired color. Rinse well and dry in shade.

Cutch; catechu — Brown

(*Acacia catechu*)

For wool or cotton

Chips of the heartwood of this and similar species of *Acacia* growing in southeastern Asia and the East Indies are boiled to make a gum resin which is the

Hodge

The nutlike fruits of the betel palm (*Areca catechu*) are one source of the brown dye known as cutch or catechu.

base for a dye. Extract of cutch is available from botanical and dye supply houses. The rich brown which it produces is especially good on wool; on cotton it is said sometimes to fade. For either material, here are the directions given in *Home Dyeing with Natural Dyes* by Furry and Viemont (U.S. Department of Agriculture Miscellaneous Publication No. 230):

> For each pound of dry wool or cotton, allow:
>
> 4 ounces cutch
> ½ ounce copper sulfate
> ½ ounce potassium dichromate
>
> Boil the cutch and copper sulfate in water until well dissolved. While still hot, put in the yarn or cloth which has been boiling a short time in clear water, stir well, and let stand overnight. In the morning squeeze the material from the cutch solution and put it into a hot bath made by dissolving the potassium dichromate in 4 to 4½ gallons of soft water. Stir well and let stand in this for 45 minutes just below boiling temperature. Rinse and dry.

An extract of the betel-nut, which is the fruit of *Areca catechu,* an Asiatic palm, is another source of cutch, or catechu, as a dye. In fact, under the name of "Bombay catechu" it is especially recommended by Ethel Mairet in *A Book on Vegetable Dyes* (published by Douglas Pepler, Hammersmith West (London), second edition, 1917).

Fustic — Yellow

(*Chlorophora tinctoria*)

For wool or cotton

Two dye-producing plants are known as fustic: *Chlorophora tinctoria,* a large tree of the Mulberry Family, native in tropical America, and *Cotinus coggygria* (*Rhus cotinus*), a large shrub of southern Europe, planted throughout the Temperate Zone as an ornamental.

The yellow wood of "old" fustic (*Chlorophora tinctoria*) yields a yellow dye which is also used in producing browns and greens. Extract of this kind of fustic is available for dyeing.

Mordant: For gold-color on wool, chrome; for yellowish tan on wool, alum; for a lighter yellowish tan on cotton, alum-tannic acid-alum.

To prepare the dye: Dissolve ½ ounce fustic extract in enough water for the dye bath (4 to 4½ gallons for one pound of wool).

To dye wool gold-color: Immediately after mordanting with chrome, rinse the wool, squeeze out the water, and immerse in dye bath. Bring to a boil, and simmer half an hour. Rinse thoroughly in several waters and dry in shade.

To dye wool or cotton yellowish tan: Wet the mordanted material, immerse in dye bath, and bring to a boil. After half an hour of simmering, remove the material, and without rinsing, immerse it in a boiling water bath containing 1/6 ounce potassium dichromate and 1/6 ounce acetic acid. Boil ten minutes in this, then rinse well and dry in shade.

One pound of finely cut fustic chips tied loosely in a bag may be used in place of the extract, but two hours of boiling will then be required.

The other fustic, known as "young fustic" (though in much longer use as a dye plant than the American fustic-tree), is also called Venetian sumac and smoke-tree. It is frequently planted as a hardy ornamental shrub. The color that it gives is less permanent than that of *Chlorophora,* so it is seldom used today.

Logwood — Gray; gray-blue

(*Haematoxylon campechianum*)

From the earliest days of world commerce in the products of the Americas, logwood chips for dyeing have been an important commodity. They produce gray, brown, black and blue. Their principal use today is for black, achieved with alum and iron, and for making ink.

The logwood tree is a relatively small one with a number of trunks. It was first known from the Bay of Campeche on the east coast of Mexico, but is common in many parts of tropical America. (See illustration, page 53.) It belongs to the Legume Family.

The recipes for gray and gray-blue given here are provided by Violetta Thurstan in her book *The Use of Vegetable Dyes,* eighth revised edition, 1964, and are reproduced here by permission of the author and her publisher, The Dryad Press, Leicester, England.

Gray-Blue for Wool with Logwood

1 lb. wool mordanted with alum and cream of tartar.
½ oz. bichromate of potash.
3 oz. logwood.
1 dessertspoonful chalk if water is very soft.

If chips are used, they should be put in a muslin bag before putting in dye-bath. If logwood extract is used (1 oz. equals ½ lb. chips), it should be thoroughly dissolved with the bichromate and chalk before the wool is entered. The dye-bath should be kept just under the boiling-point for three-quarters of an hour. Then the wool is taken out and washed.

Gray for Wool with Logwood

1 lb. wool, mordanted with ½ oz. bichromate of potash and 1 oz. cream of tartar.
4 oz. logwood.

Method: After the wool has been in the mordant bath for a quarter of an hour, remove it, and add the logwood chips (previously boiled for twenty minutes). Re-enter the wool, and continue simmering for another half-hour.

TROPICAL AMERICA'S ACHIOTE

Capsules of achiote (*Bixa orellana*). The flesh surrounding the seeds provides an important red dye.

Hodge

THE fleshy red pulp that surrounds the seeds of achiote (*Bixa orellana*) provides a red dye that is widely used by native craftsmen in tropical regions around the world. A native tree or shrub in tropical America, it is cultivated in Asia and has run wild in Africa. It goes under various other names—annatto, urucu and roucou among them.

Few other colorings from plants are used in tropical America. However, a pamphlet on Venezuelan dye plants will soon be available from the Instituto Botánico in Caracas.

DYE PLANTS 'ROUND THE WORLD

An introduction to the pages that follow

On a radio program early in 1964, the young American-born Queen of Sikkim was being queried about the folk arts of her new country. The eagerness with which she spoke of vegetable dyes from native plants stirred our imagination. The plan for "Dye Plants Round the World" was at that moment conceived.

Visions of softly colored Sikkimese fabrics, of Indian silks, Indonesian batiks, Scandinavian handweaving from home-dyed yarns, Scottish tweeds and tartans, and textiles colored with African plants served as a stimulus. Letters were directed to many lands in our search for people who might be able to furnish information about the survival or rediscovery of methods of dyeing by hand with natural products. Realization that we are living in an age of factory-made aniline dyes made our quest especially challenging.

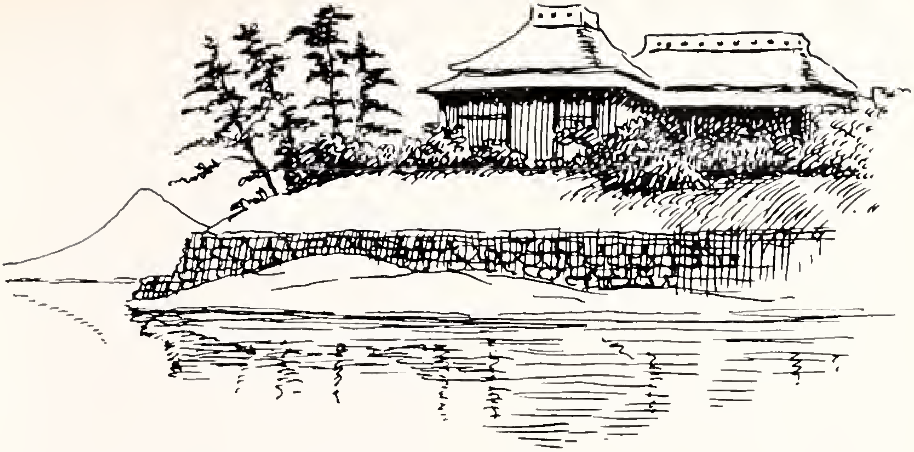
About this time, a small book of dyeing recipes from the Penland School of Handicrafts was sent in by a Botanic Garden Trustee. As a result, I spent a delightful week in the Blue Ridge Mountains of North Carolina, where the Penland School teaches vegetable dyeing, learning from Miss Catherine Morony how to collect, prepare and use the dye plants of the region. This knowledge had been passed down to her by a previous instructor, who in turn was a disciple of the compiler of the original recipes. This brief experience at Penland was invaluable as a background for the coordinating of manuscripts and information for this Handbook.

It seems that there is a newly-awakened interest, particularly among handweavers, in the softer and more subtle color tones achieved with natural materials. Many craftsmen in the United States are now using dyes from plants. The Scandinavian countries are famous for handwoven articles, and, through Botanic Garden friends there, we have been fortunate in obtaining recipes from Norway and Sweden.

Letters to two Japanese friends of the Botanic Garden produced a wealth of information from their country, as well as a monograph in Japanese on a plant-dyeing process that is being revived in Japan. Dr. Tomoya Funahashi, a busy ophthalmologist in Nagoya, spent many evenings translating the monograph into English for our publication of this Handbook. Other correspondents in Scotland, Eire and Northern Ireland have supplied information on the use of vegetable dyes in tweeds. One of these, the Duke of Abercorn, while attending a YMCA meeting, heard of a weaver who spins and dyes the hair of Samoyed dogs with extracts from plants of the English wayside. The Canadian Handicrafts Guild has put us in touch with weavers and dyers in that country. My mother, herself a weaver, was able to supply the name of a fellow craftsman who has experimented with plant dyes in South Africa. And so it has been with our correspondents around the world.

As this is written, I am in Japan with a Botanic Garden colleague. We are on our way around the world, gathering, among other things, still further information on dye plants and ways of using them.

Elizabeth Scholtz
Kiyosato, August 1964



HOME DYEING A HOBBY IN JAPAN TODAY

REPORTS of the use of dye plants by the primitive Ainu of northern Japan prompted a letter to Kan Yashiroda of Shodo Island in Japan's Inland Sea. Replying on handmade paper colored with a particular kind of dayflower (*Commelina communis hortensis*) grown for the purpose in only one village, Mr. Yashiroda discounted the belief that the Ainus are continuing some of their traditional crafts. "They are too much modern-seekers and too easy going," he remarked. Formerly they used principally the bark of alder and walnut and the wood of yew as dyes.

The fewer than 15,000 Ainu of today are descendants of an aboriginal people who were driven northward many centuries ago by incoming Japanese. Scattered in small villages on the island of Hokkaido, they are protected by the Japanese Government, much as American Indians that remain on reservations are wards of the U.S. Government.

Calling himself and his friends "primitives who hold home crafts in high esteem," Mr. Yashiroda tells here of present-day interest in using dye plants.

Kan Yashiroda

AMONG my own friends, several have been preparing plant dyes themselves and dyeing their own neckties, neckerchiefs, handbags, underwear, and a number of other things. Indeed, a great number of plants in numerous genera are used, according to the color, tones, and shades wanted and the nature of the fabrics dyed.

Sometimes when we are on mountaineering or walking trips I find some are eager to seek plants for dyes, or just to enjoy seeing these very plants growing. A large number of plants used for dyes are native to my home Island of Shodo.

For centuries, in the pre-aniline days, the indigo or anil industry from the cultivated *Polygonum tinctorium* in Tokushima prefecture produced annually a tremendous amount of the indigo-ball to meet the whole of Japan's needs. When I was a schoolboy, there was a dyer near my home. He had in his works ten or more indigo dye-vats, some 3 feet wide and 5 feet deep, filled with distilled indigo, or *ai*. Almost daily I played around the vats with his son, who was my classmate. The dyer was kept busy driving us away from the dangerous vats. A town master's grandson was a worse one!

When I went to Tokushima to see a wisteria bonsai show not long ago, I was told that it is very difficult to find a cultivated specimen of *Polygonum tinctorium,* even in the prefecture where it once was grown commercially. I used to grow it in my garden and used it as a culinary herb, as was often done ages ago.

The commonly used dye plants of olden times, which are still occasionally used, include the following:

Holly (*Ilex pedunculosa*) leaves or bark: reddish brown with alum, brownish black with iron, yellowish brown with lye, reddish brown with lime.

Cryptomeria (*C. japonica*) bark: brownish yellow with lime, bluish black with iron.

Japanese mountain cherry (*Prunus* species) bark: brownish yellow with lime, gray-green-yellow with iron.

Japanese maple (*Acer palmatum*) leaves: brownish yellow with lime, bluish purple with iron.

Camellia (*C. japonica*) leaves: brownish yellow with lye, greenish gray with iron. Bark: reddish brown with lime, grayish black with iron. It is only comparatively recently that the leaves have been used.

Ampelopsis (*A. brevipedunculata*) leaves are said to give the best reddish-brown dye with lime as mordant.

Plum (*Prunus mume*) wood: reddish brown with lime, light yellowish brown with lye, light bluish black with iron, blackish brown with lime and iron.

Persimmon (*Diospyros kaki*) juice of astringent fruit: brown without mordant, bluish black with iron. (When I was young I also saw the leaves used for dyeing.)

Gardenia (*G. jasminoides*) juice of fruit: yellow without mordant.

Buhle

Either leaves or bark of this native Japanese holly (*Ilex pedunculosa*) may be used in dyeing. Brownish black, or yellowish to reddish brown comes from the bark, according to the mordant used. In the Kusaki-zome book (see page 44), pale red coloring is said to be produced by the leaves.

Scholar-tree (*Sophora japonica*) flowers: yellow with alum, clear yellow with stannous chloride, yellow tinted with red with copper sulfate, brownish yellow without a mordant.

Sumac (*Rhus chinensis*) bark: pale yellow without a mordant, also with lye; light yellowish brown with lime, brownish black with iron. The leaf-galls are also much valued for dyeing.

Bark of chestnut (*Castanea crenata*), oaks (*Quercus serrata, Q. dentata,* and *Q. acutissima*), sumacs (*Rhus* species) and *Mallotus japonicus* are said to yield very fine black dye with iron, brown without. Bark of *Myrica rubra* yields a valuable dye for fishing-nets: yellow with alum, brown with lime, brownish-yellow without a mordant. ✦

PLANT-DYEING PECULIAR TO JAPAN

Kusaki-zome Brought Up to Date

REVIVAL in Japan of "Kusaki-zome"—or dyeing with natural materials—has been stimulated by the publication in 1961 of a monograph on this primitive art. Knowledge of the method, which reached its full development in Japan in the Asuka and Nara periods (eighth century) might have disappeared had not a movement for its restoration been initiated in 1929.

The book, by Akira Yamazaki (published by Getsumei-Kai, Ltd., in Kakio Kawasaki, Kanagawa, Japan) contains descriptions, illustrations and botanical notes on the plants utilized in natural dyeing; the history of this dyeing process, based on official records and in contemporary literature; and a complete explanation of the process itself. To illustrate the colors obtained, skeins of dyed silk thread have been attached to the pages.

A two-page introduction in English includes a Preface, Plants Used as Dye Sources, and Dye Materials and Dye Processes. There is also an English-Japanese index. The book was published in a limited edition of 1,000 copies. It contains 78 pages. Some of the illustrations are in color.

Fifty plant dye sources are taken up, and these include plants of foreign origin as well as native Japanese species. Among the foreign plants are several from India which have become known around the world for their dyeing properties: sapan (*Caesalpinia sappan*), called suoh; turmeric (*Curcuma longa*)—ukon, and catechu or cutch (*Areca catechu*)—called binroju in Japanese.

The method used for a selected number of the dye plants treated in this book is given in the translation which follows.

The book itself, with Dr. Funahashi's translation, is available for reference in the library at the Brooklyn Botanic Garden.

Akira Kamazaki

Recipes translated by Tomoya Funahashi, M.D.

Bengal Madder (*Rubia cordifolia* var. *mungista*)

The red-yellow roots of this plant are used for dye. They are gathered in late fall and are washed in running water until the yellow juice in them is washed away. They are then dried.

Method of dyeing: First the dried roots are washed in water until they turn reddish. They are then boiled in a pan, but not one made of iron. The cloth is dipped in this extract. For mordanting, ash extract is used. To stain cloth cardinal color, the dyeing must be repeated at least twenty times.

Gromwell (*Lithospermum officinale* var. *erythrorhizon*)

The root is used for dyeing. It should be handled at temperatures lower than 60 degrees Centigrade (140 degrees Fahrenheit); if the temperature is higher the color turns black-violet.

At first, the dried roots are kept in warm water for 24 hours. When they turn soft they are crushed into a muddy juice. This is filtered through linen. The cloth to be dyed is first dipped in ash extract made from *Camellia japonica* or *Symplocos crataegoides* (recently potassium carbonate is also used), then in the extract of the roots. When the dye is well absorbed the cloth is dipped into the ash extract again and held there until it is stained violet. It is then dried in the sunlight. This procedure is repeated 40 to 50 times until real violet color is obtained. Wine-red color is obtained by double staining with *Caesalpinia sappan* and *Lithospermum officinale*.

Sapan or **Bukkum-wood** (*Caesalpinia sappan*)

This tree does not grow in Japan but trunks of it were imported in Japan from India as early as 900 B.C. The wood of the trunk is used for dye. It is first chopped fine then boiled, but not in a pan made of iron.

A variety of colors can be obtained from this extract by using different mordants. For instance, Botan-iro, ashes of roses, is gained with ash extract; Aka-iro, real red, with alum; and wisteria-violet with iron water.

Iron water is made as follows: rusted iron is thrown in to a mixture of vinegar and water and is well boiled. It is left for one day and night and then the iron is taken out.

Safflower (*Carthamus tinctorius*)

The flowers of this plant are used for dye. They are gathered in June or July, early in the morning, placed in a wooden bucket, covered with water and trampled under bare feet. The yellow juice from the flowers is washed away in running water and then the trampled flowers are covered with matting, moistened with water, and kept moist for three days and nights. When the flowers become mellow they are crumpled between the hands and made into round cakes about 1½ inches in diameter which are dried in the sun. These cakes are called Hanamochi, or flower cakes.

To dye with flower cakes both ash extract and vinegar are needed. Ash from rice straw, wood or lamb's-quarters (*Chenopodium album*) is best, although potassium carbonate may also be used. The ash extract separates the dye from the flower petals; the vinegar is used as the mordant.

The dyeing process: Hanamochi flower cakes are soaked in water for 24 hours, then crushed with the hands to extract the yellow juice, which can be used to dye cloth yellow. When the crushed flower cakes are put into a bucket with ash extract the red flower petals turn red-brown at once, but later turn red again. After they have turned red they are strained through linen or cotton. When vinegar is added, the strained solution turns bright red and is ready for dyeing.

Dyer's Knotweed (*Polygonum tinctorium*)

The plants are cut down before flowering, spread on the ground and dried in the sun. They are then stored in a room—"a room for plants to sleep"—and watered occasionally to induce fermentation. In 80 days *Bacillus indigogenus* turns the plants into a black mass called Sukumo Ai, which is pounded in a mortar into a flat, oval solid known as indigo-ball.

To dye cloth: half of an indigo-ball is chopped and dissolved in alkali water in a large pot. The pot is filled with water to which is added one liter each of lime, bran and soda ash, and 1½ liters of wood ash. The mixture is well stirred and heated up to 20 degrees Centigrade (68 degrees Fahrenheit) with occasional stirring until it foams. In five to ten days the bubbles which have formed on the surface turn blue and the water turns reddish; then one liter each of lime and bran is added. After two or three days 500 cc. of lime and 500 cc. of bran are added to keep the solution alkaline. After two weeks it is available for dyeing. To dye cloth to Kame-nozoki, a very pale blue, merely dipping cloth in the solution is enough; to dye to Asagi-iro, or French blue, two or three dippings are needed; and to dye to Kon-iro, which is navy blue, ten or more dippings are necessary.

Mercury (*Mercurialis leiocarpa*)

Leaves of this plant are pounded in a mortar and put into a large pot which is filled with water and left in the sun five or six days. With alum mordant, this solution will dye cloth blue.

Cape Jasmine (*Gardenia jasminoides* var. *grandiflora*)

Ripe fruits of gardenia, either fresh or dried, are used. Dye is extracted from fresh fruits by squeezing; from dried fruits by boiling. They are mordanted with ash extract or alum. Gardenia and

Scholtz

This painting of the indigo or "ai" plant of Japan (*Polygonum tinctorium*) is the frontispiece of the book on ancient Japanese methods of dyeing with plants (Kusakizome), parts of which are translated here.

alum produce yellow dye; gardenia and indigo, green.

Gallnuts

Gallnuts are swellings on leaves of *Rhus javanica* caused by a parasitic insect. In fall the gallnuts turn yellow-red, as beautiful as coral. Then they are gathered, steamed and dried.

To dye: gallnuts are put in a pan, not an iron one, covered with hot water and boiled. After cloth has been dipped in this solution, it can be mordanted with cold iron water to produce violet gray, or with hot iron water to produce grape gray. (To make iron water, see directions under Sapan, page 42.)

Pomegranate (*Punica granatum*)

Hard skins of the fruit are dried under the sun, chopped and stored. To dye cloth: extract of fruit skins is prepared in boiling water. After cloth is dipped in this solution it may be mordanted with ash extract or with alum for yellow; with iron water for tea brown; and with iron water followed with ash extract for violet blue.

Turmeric (*Curcuma longa*)

Roots of the plant are chopped into a powder, which is dissolved in water, cold or warm. After cloth is dipped into this solution it can be mordanted with ash extract or with citric acid to obtain yellow; with iron water followed with calcium hydroxide for gold brown. For scarlet, cloth is first dyed with *Curcuma longa*, then with *Carthamus tinctorius.*

Walnut (*Juglans sieboldiana*)

The green skin is used for dyeing. It is separated from the hard walnut in a mortar and is dried. It turns black in dried condition.

For dyeing, the dried skins are boiled to obtain their thick extract. When mordanted with iron water, this extract produces violet gray; if lime is used as the mordant, red-purple-black can be obtained.

Japanese Chestnut (*Castanea crenata*)

The extract of the nut-shell, burr and bark of this tree can all be used for staining. When mordanted with iron water, gray color is obtained. When ash extract is added to the iron water, chestnut brown can be expected. The male flower of the chestnut can be used to stain cloth a red-brown color.

Japanese Sumac (*Rhus trichocarpa*)

The red leaves are collected in the fall, dried and kept for later use. To prepare dye, the dried leaves are chopped and boiled (an iron pan should not be used). From the extract, when mordanted with iron water, gray black can be obtained. When cloth is stained with *Polygonum* first and then with *Rhus trichocarpa,* real black can be obtained.

Buhle

The shell, burr and bark of the Japanese chestnut (*Castanea crenata*) are all used for dyeing. Gray is produced with iron water mordant; the color changes to brown when an extract of ashes is added to the mordant.

Japanese Holly (*Ilex pedunculosa*)

Leaves of this tree are gathered in early winter, pounded and crushed in a mortar, and placed in a pot. Water is added and the pot is left for five or six days in the sun. Cloth is stained with this water and mordanted with alum. Pale red is the color obtained.

Wax-tree, Redlac Sumac (*Rhus succedanea*)

When the extract of the trunk of this tree is mixed with an equal quantity of the extract of *Caesalpinia sappan* and mordanted with vinegar and ash extract, brilliant red-yellow color can be obtained. In olden times this color was used only for emperor's clothes.

Nandina (*Nandina domestica*)

Yellow stems of this plant are cut in the fall, chopped in small pieces and stored. Cloth dipped in the thick extract from these stems and mordanted with iron water will be bluish brown; when lime is the mordant yellowish brown can be expected.

Azalea (*Rhododendron japonicum*)

Leaves of this tree are collected in late fall. Cloth is dipped in the extract made from the leaves, then mordanted with iron water to obtain gray black. When mordanted with lime, red brown is obtained.

Ginkgo (*Ginkgo biloba*)

This tree has two layers of bark. Outside is corky, inside is fleshy. The extract of the inner bark is used to stain cloth whitish brown when mordanted with ash extract or with lime.

Sweet Potato (*Ipomoea batatas* var. *edulis*)

The leaves of the sweet potato are dried under the sun and kept in dried condition. Cloth is dipped in the concentrated extract of the leaves and is mordanted with iron water. The color obtained is a yellowish blue-brown.

Soy Bean (*Glycine soja*)

The extract of black soy beans is prepared in a pan (not an iron pan) in boiling water. Cloth dipped in this extract is stained violet brown. When this cloth is mordanted with iron water the violet brown turns into blue gray, and then into silver gray. ◆

Buhle

Inner bark of the ginkgo tree (*Ginkgo biloba*) stains cloth a whitish brown, according to Kusaki-zome directions.

THAILAND

BUDDHIST RULES PRESCRIBE DYES FOR MONKS' ROBES

Jack-fruit among many plants used for textile coloring in Thailand

Kasin Suvatabandhu

THE yellow robes of Buddhist monks in Thailand are made and dyed according to regulations set down in the monks' book of discipline. White and all bright colors are prohibited. While the book does not specify the correct color, early religious authority interpreted the instructions to mean that the robe, when made, should be dyed a color in between yellow and red. For that reason, orange and bright yellow being specifically barred, the dull yellow color so often noted on the streets of Bangkok and elsewhere is recognized as the correct tone in Thailand.

Nowadays, however, brighter yellows are often seen, for aniline dyes are replacing the old-time plant dyes. When natural plant dyes are used, heartwood of the jack-fruit tree (*Artocarpus integrifolius*) is the preference. But before the dye is applied, the prepared robe is put in a vat containing a hot or cold water solution made from a decoction of cow dung or red earth or selected plant parts—root, rhizome, bark, wood, flowers or fruits, depending on the requirements. The jack-fruit wood is cut into fragments or slices and boiled in water until the solution is dark brown in color. The wetted robe is then dipped in that solution and held there until the required dirty yellow is obtained. When the robe has dried it is ready to be used under the name of *Kasaya.*

The rhizome of the plant that gives turmeric (*Curcuma longa*) is also used for yellow; likewise the corolla-tube of

Hodge

Jack-fruit (*Artocarpus integrifolius*). The striking yellow robes of Buddhist monks are dyed with heartwood of the jack-fruit tree.

the tree-of-sorrow (*Nyctanthes arbor-tristis*), and the juice of the porcupine orange (*Citrus hystrix*), but the brightness of the color of these has to be held in check by the addition of foreign matter, such as teakwood, coconut fiber, or leaves of *Diospyros mollis,* a kind of persimmon.

These and other plants that are used in Thailand for dyeing include the following:

Black

- *Diospyros ehretioides* (*D. mollis*), a persimmon relative—fruit
- *Elipta alba*—leaves
- *Harrisonia perforata*—fruit
- *Piper methysticum,* kava—root
- *Terminalia bellerica,* myrobalan—fruit

Khaki

- *Artocarpus integrifolius,* jack-fruit—heartwood
- *Curcuma longa,* turmeric—rhizome
- *Oroxylon indicum,* a trumpet-flower tree—bark
- *Tectona grandis,* teak—heartwood

Green

- *Ananas comosus,* pineapple—leaves
- *Garcinia dulcis,* mundu—bark, heartwood
- *Sesbania grandiflora,* a small leguminous tree—leaves
- *Terminalia* species, myrobalan—leaves and bark

Yellow

- *Artocarpus integrifolius,* jack-fruit—heartwood
- *Citrus hystrix,* Kaffir lime or porcupine orange—fruit
- *Cudrania javanensis,* of the Mulberry Family—heartwood
- *Curcuma longa,* turmeric—rhizome
- *Morinda tinctoria* (*M. coreia*), a small tree in the Madder Family—root
- *Nyctanthes arbor-tristis,* night-flowering jasmine, or tree-of-sorrow—corolla-tube
- *Rauwenhoffia siamensis*—bark

Orange

- *Bixa orellana,* roucou, or annatto—seeds and leaves
- *Carthamus tinctorius,* safflower—flower

Red

- *Baccaurea sapida,* rambai—wood
- *Bixa orellana,* roucou, or annatto—seeds
- *Morinda* species—root

⁂

FURTHER NOTES ON DYES OF THAILAND

Thao Pheng Sananikone

WHEN the rhizome of curcuma is used for yellow, it is ground into a coarse powder, mixed with water and filtered. With lime added, the yellow turns to orange. The orange dye from roucou (*Bixa orellana*) is contained in the seeds. When dry, the seeds are dipped in water for only a few minutes to give a dye solution. This is a South American tree that is widely planted in the tropics. In the New World it is known as annatto or achiote.

Two kinds of indigo are used in Thailand, *Indigofera sumatrana* and *I. arrecta.* Leaves of these plants are fermented in water for a night. This juice is then agitated, after which operation indigo is left at the bottom of the container. Water is drained off and the indigo is left to dry. It produces navy blue color, nearly black. The only inconvenience of indigo is that perspiration on it has a very strong smell.

Mordants are apparently not used with vegetable dyes. While table salt is added to the bath made with *Diospyros,* and slaked lime with indigo, it does not appear that these chemicals aid in fixing the dyes into the fibers. Salt acts only as a leveling agent and slaked lime is a developing agent for all vat dyes. For comparison, the Thai Silk Handweaving Factory uses caustic soda with the group of chemical dyes known as indigosols. ✦

SIKKIMESE PLANTS GROWN FOR DYEING

FROM the palace in Gangtok, Sikkim, where the Queen herself—the Maharani or "Denjong Gyalmo"—is interested in native handicrafts, comes a list of plants that are grown locally and used for dyeing in the Palden Thondup Namgyal Institute in Gangtok. The native names have been supplied by the Sikkim Government Orchid Sanctuary and by the Conservator of Forests for the Government of Sikkim.

Ongit Targain

Brown

Persian or "English" walnut (*Juglans regia*) and black walnut (*J. nigra*), both called "okhar" in the Nepali language

Green

Zeodary (*Curcuma zeodaria*), leaves of a dye and spice plant similar to turmeric; in Nepali, "keshari"

Mahonia napaulensis leaves

Myrsine semiserrata; in Sikkimese, "sanghe"

Yellow

Zeodary (*Curcuma zeodaria*) bark; in Nepali, "keshari"

Mahonia napaulensis bark

Rhubarb (*Rheum nobile*); called "chucha" in Tibetan, "bushing" in Sikkimese

Sorrel (*Rumex nepalensis*); in Nepali, "halhali"

Orange

Mallotus philippinensis; in Nepali, "sindurey"

Red

Rubia cordifolia, a madder relative; in Nepali called "majhito"

Yellow raspberry (*Rubus ellipticus*) also called "majhito" in Nepali

In addition to the plants, a lac insect (*Tachardia lacca,* also called *Lucifer lacca*) that lives on various trees, particularly species of *Ficus,* provides red and purple dyes in Sikkim. ✦

INDUSTRIAL TANNINS AND DYES OF INDONESIA

MANGROVE, many species of which grow wild along the coasts, is Indonesia's chief native source of dyes and tannins. All other dye materials produced there come from cultivated plants. Mangrove bark has been exported in large quantities as a tanning agent.

Bark of *Acacia decurrens* has been similarly exported. The tree was introduced from Australia and is extensively cultivated.

Gambier, from *Uncaria gambir,* a Malayan tree, is produced for tanning by boiling twigs and leaves. It is also used for dyeing silk black. The tree is cultivated in Sumatra and West Borneo. [Two thirds of the gambier produced, however, is combined with the leaf of the betel pepper (*Piper betle*) and chewed by most of the populace.]

Divi-divi (*Caesalpinia coriaria*), native in Central America, is cultivated both as an ornamental and an occasional commercial crop. The S-shaped pods are rich in tannin.

Another product originating in tropical America is annatto, from *Bixa orellana.* The shrub was introduced to Indonesia for garden use. Eventually the orange-yellow coloring matter from the seeds became an export for the dairy industry of Holland.

Formerly there was a flourishing indigo industry in Indonesia for export, but this has all but disappeared. Only in middle Java is there now a small production of indigo for the batik industry. ✦

(Adapted from L. van der Veer, "Producten van Indonesië," in *Insulinde,* 1947)

MALAYAN DYE PLANTS

THE tropical peninsula that extends oceanwards some 750 miles off the southeast coast of Asia contains a large number of dye plants, most of them trees. Few, however, are used commercially, except for those connected with the batik industry. The dye plants of Malaya mentioned here are only a sampling of the many that are listed by I. H. Burkill in *A Dictionary of the Economic Products of the Malay Peninsula,* published by Crown Agents for the Colonies, London, 1935.

Black, which in other countries is often difficult to get from native plants, is obtainable from the leaves of a number of Malayan plants. Among them are Chinese tallow-tree (*Sapium sebiferum*), guava (*Psidium guajava*) and persimmon (*Diospyros kaki*), the fruits also used.

There are also several sources of blue: the wood of *Moringa oleifera,* the leaves of *Wrightia tinctoria* (a tree of India and Burma) and the small shrubby (or herbaceous) plants *Strobilanthes cusia* and *Marsdenia tinctoria.* Several other plants are used with indigo: the seeds of *Cassia tora;* the bark of *Ceriops tagal* (a mangrove) to give black, brown or purple; the milk and sap of coconut (*Cocos nucifera*) to produce green; the burned pods of *Parkia* to intensify the blue; and *Terminalia bellerica* as an adulterant of indigo for cheap fabrics.

Red is obtained from the bark of *Columbia serratifolia,* also from several species of *Erythroxylon* and *Eugenia,* the latter giving good color on cotton. The roots of some species of *Morinda,* of the Madder Family, give a red dye, as well as purple and chocolate. Other species yield yellow coloring. The wood of *Peltophorum dasyrachis,* of the Pea Family, dyes red; the bark colors cotton yellowish brown. Dyes from *Morinda* and *Peltophorum* are widely used in the batik industry. The bark and wood of several kinds of *Pterocarpus* give various shades of red on wool and cotton.

Species of *Symplocos* (relatives of the cultivated Asiatic shrub called sweetleaf, *S. paniculata*), have bark which produces a yellow dye and a mordant. With certain other dye plants, it gives red.

An orange-red comes from the wood of *Pterospermum acerifolium,* notably in Thailand, just north of the Malay Peninsula. When clear orange is wanted on silk, fruits of the cucumber-tree or bilimbing (*Averrhoa bilimbi*) are used as an adjunct with other dyes.

Sources of yellow dye, common among the herbaceous plants of the Northern Hemisphere, seem to be less frequently found among woody plants of equatorial regions, as in the Malay Peninsula. Besides some species of *Morinda,* mentioned above, the berries of *Ardisia solanacea* give yellow, as do the leaves of *Xanthophyllum excelsum* and the wood of *Coscinium fenestratum.* Fruits of *Terminalia chebula* give yellow with an alum mordant; with *T. procera,* the bark dyes yellow, the fruits black. Other yellows come from combinations of several plants.

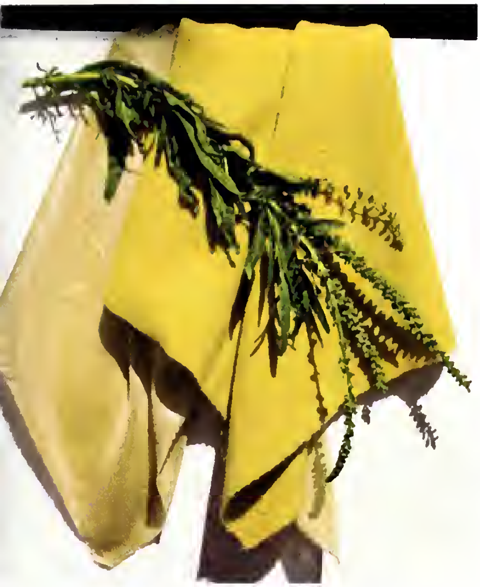
Green is not often produced by one plant alone. The shoots of *Nephelium lappaceum,* a relative of the litchi-nut, will dye silk green if combined with turmeric. (The fruit produces black on silk that has first been dyed red.) A yellowish green is obtained from *Sapium indicum,* a relative of the Chinese tallow-tree.

Yellowish browns come from the leaves of *Tectona grandis,* the wood and bark of *Intsia bakeri,* and the roots of *Ixora longituba. Thespesia populnea* provides a brown dye for wool but not for silk.

Some trees give several colors. The heartwood of *Cudrania javanensis* contains a yellowish-red dye, which becomes orange-green with turmeric and green with indigo. Flowers of *Cedrela toona* of the Mahogany Family can produce dyes of yellow, red or brown.

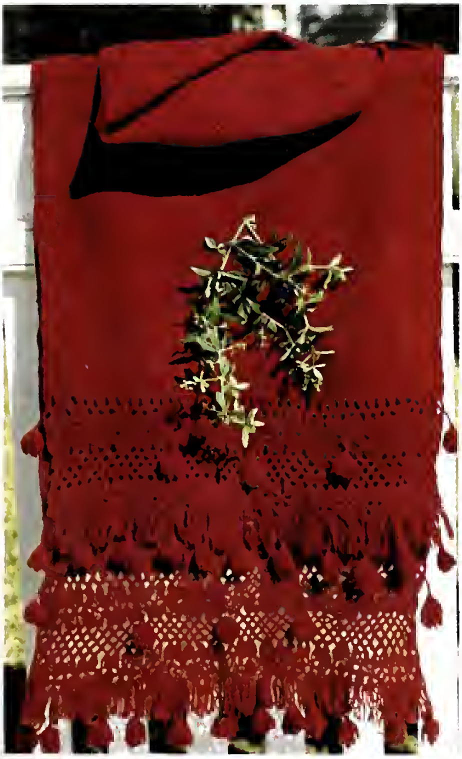
The west coast of the Malay Peninsula is lined with mangrove swamps, and the bark and roots of many mangrove species have served as dyes and mordants. ◆

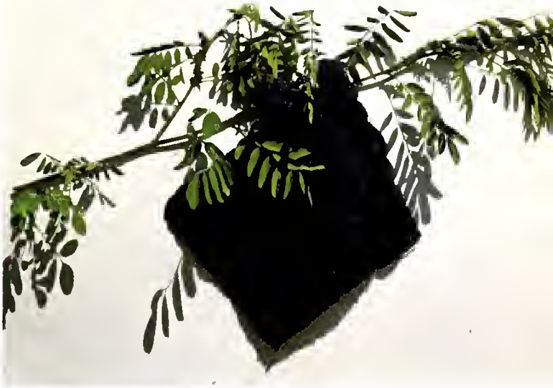
PERMANENT COLORS FROM PLANT DYES OF ANCIENT USAGE



Silk (left), wool (right), dyed with weld (Reseda luteola); a weld plant in flower.

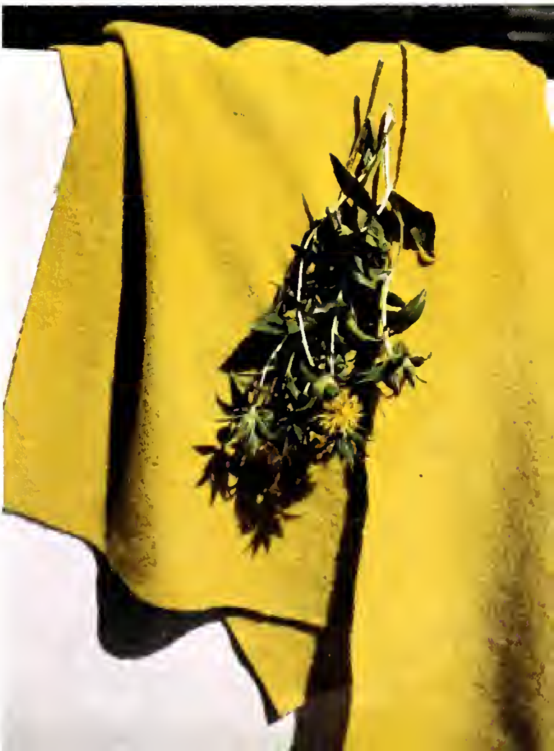
Woolen scarf dyed with roots of madder (Rubia tinctorum), the best vegetable source of red.



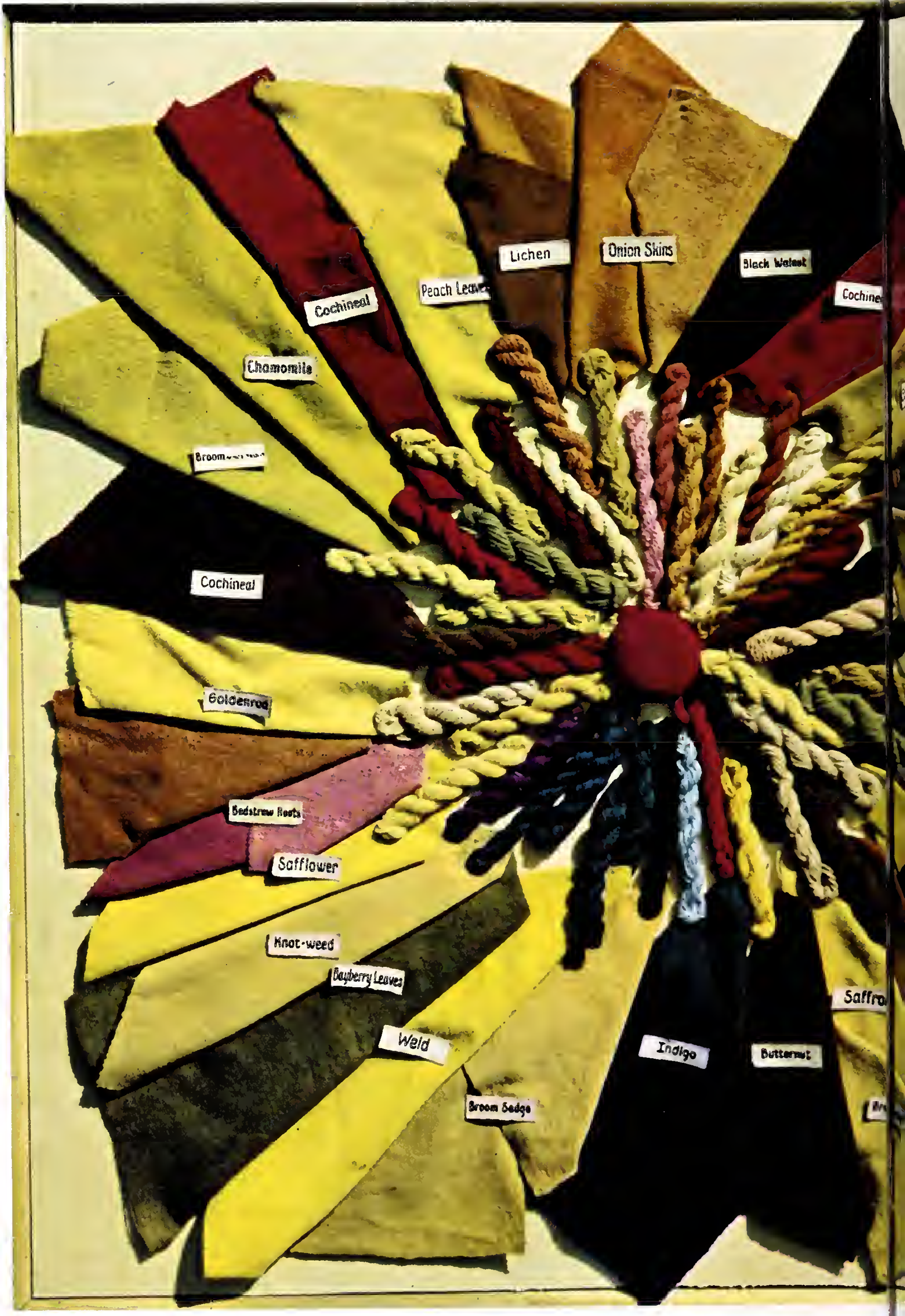


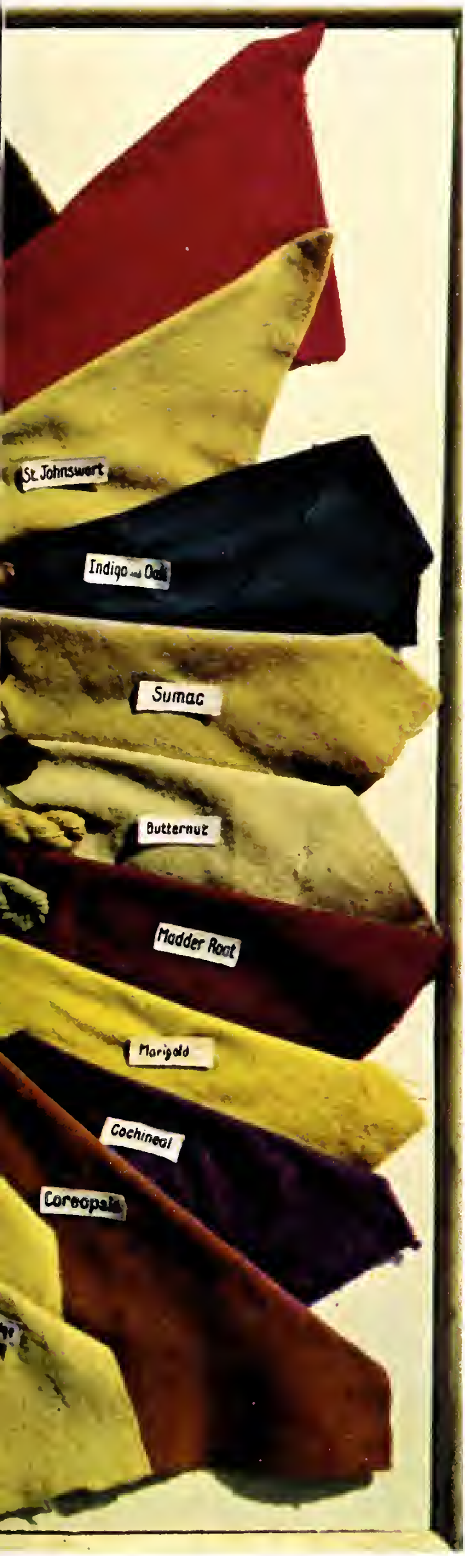
Wool dyed with indigo (Indigofera tinctoria), a dye plant first used forty centuries ago.

Wool dyed with safflower (Carthamus tinctorius). Safflower can also be used on silk.



Fabrics dyed by E. McD. S.


Lichen
Onion Skins
Black Walnut
Cochine
Peach Lea
Cochineal
Chamomile
Broom
Cochineal
Goldenrod
Bedstraw Roots
Safflower
Knot-weed
Bayberry Leaves
Weld
Broom Sedge
Indigo
Butternut
Saffro



RANGE OF COLORS OBTAINABLE FROM NATURAL DYES ON WOOLEN YARNS AND FABRICS

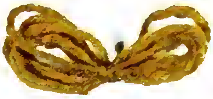
EXCEPT for cochineal (an insect) plants have supplied all these hues. Madder, indigo, saffron and cochineal dyes are obtainable from commercial supply houses. Some of the plants named here may be gathered from the woods and fields, then dried for later use. Others may be grown in a garden.

Dyed and arranged by E. McD. S.

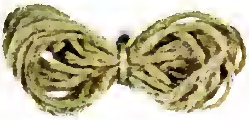
A CHILD'S EXPERIENCE WITH PLANT DYES

THE YARNS illustrated here were colored in the early 1940's as a special project in the children's program of the Brooklyn Botanic Garden. Colors remain strong after more than two decades. The 14-year-old who did the work achieved varied colors through the use of different plants and mordants.

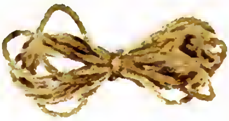
BROOKLYN BOTANIC GARDEN
CHILD'S DYEING PROJECT



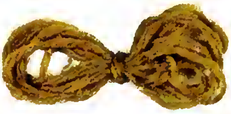
ONION
Alum Mordant



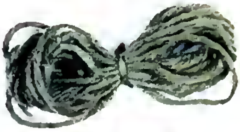
GRAPE AND ONION
Alum Mordant



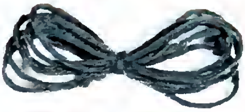
GRAPE
Alum Mordant



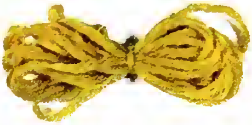
ONION
Chrome Mordant



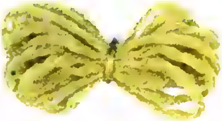
GRAPE AND ONION
Chrome Mordant



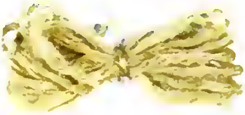
GRAPE
Chrome Mordant



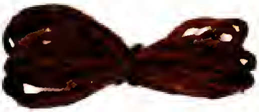
LICHEN



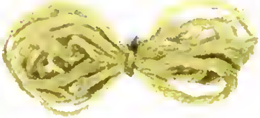
AGERATUM FLOWERS



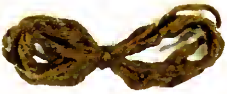
SPANISH MOSS



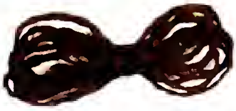
DAHLIA FLOWERS



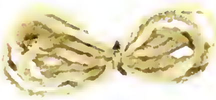
PRIVET LEAVES



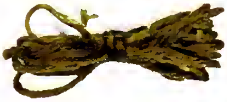
SUMAC BERRIES
Alum Mordant



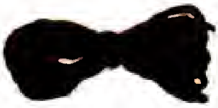
MADDER
Alum Mordant 2



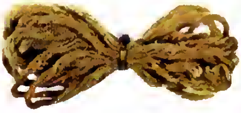
BUTTERNUT



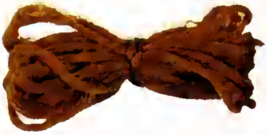
SUMAC BERRIES
Chrome Mordant



MADDER
Alum Mordant 1



BLACK WALNUT



ZINNIA FLOWERS

TROPICAL TREES AS DYEWOODS

DYE-producing trees of tropical regions have linked the hemispheres since trade was first begun East and West. Logs of dye-woods from India found their way to Europe over some of the earliest trade routes. As soon as the New World's products became known, they were in demand in Europe, and today are found in many parts of tropical Asia and the islands of the South Pacific. Barwood from Africa, once it crossed the ocean westward, was in steady demand among dyers in the Americas.

Sapan wood (*Caesalpinia sappan*) reached Venice in the 12th century from Sumatra, Ceylon and India. Later, other species of *Caesalpinia* were found to have been so long in use in South America under the name of *brasil* (which became "brazilwood") that they had already given their name to that continent's largest country.

Columbus' discovery of America and Vasco da Gama's sea route to India were decisive events in the development of Europe's dye trade. Later, when wood from tropical trees was imported in great quantity for mills, their influence was felt in America. Most important in the early American dye houses were brazilwood (*Caesalpinia brasiliensis*) for red and purple; logwood (*Haematoxylon campechianum*) for browns and black, also blue, and fustic (*Chlorophora tinctoria*) for yellow.

Under such common names as brazilwood, peachwood, sappan and others, several species of *Caesalpinia,* all with the same coloring matter, were known as "soluble redwoods." The "insoluble redwoods" were of different genera in the *Leguminosae* and were inferior. These included camwood or barwood (*Baphia nitida*), a leguminous tree from west tropical Africa; and red-sanders or red-sandalwood (*Pterocarpus santalinus*) from India. These last were of greatest value in compound shades made with logwood, madder and fustic.

Hodge

The wood of logwood (*Haematoxylon campechianum*) has been used for dyeing in gray, brown, black and blue ever since its discovery in Mexico by Europeans in the 16th century.

Logwood, native of the Bay of Campeche, Mexico, also of Honduras, the West Indies and northern South America, is a hard, heavy wood of deep red color. Its low price and its dependability for brown and black dyes made it valuable, but it never gives a stable blue dye, though widely used on cheap cloth.

Fustic, from *Chlorophora tinctoria,* a tree of the Mulberry Family from the West Indies and South America, is not to be compared with the ancient Venctian fustic from the smoke-tree (*Cotinus coggyria*). Yet the American tree is used commercially today, and an extract from it is available for yellow coloring.

The Osage-orange (*Maclura pomifera*), native to the central United States, therefore not a tropical tree, contains the same coloring matter as fustic in sufficient quantities to have made it commercially valuable as a dye plant.

Two unrelated Asiatic trees, both known as cutch or catechu (*Acacia catechu* and *Areca catechu*), are mentioned on pages 35 and 36 among dye plants of ancient usage. Gambier (*Uncaria gambir*) is also called catechu because of its similar brown dye. ✦

SOUTH AFRICA

MORDANT DETERMINES COLOR

A South African dyer tells how she obtains four colors from one dye

Nine Hellig

WHEN the same dye is used with different mordants, the resulting colors are different but are likely to blend when woven together. Experience has taught me that, while some dyes are more successful with one mordant than another, even if one or two may be uninteresting alone they serve to accentuate the better colors when used in combination.

For every wool bath I prepare, I always test the color on four skeins of wool, each previously mordanted in a different solution. I divide my dye into four equal portions, using four different pots.

In preparing the dye, I generally use one pound of vegetable matter to dye one pound of wool. With logwood, however, the dye is so concentrated that I use less.

The mordants I mix for each pound of wool are these:

tin—½ ounce stannous chloride plus 2 ounces cream of tartar
iron—½ ounce ferrous sulfate plus 1 ounce cream of tartar
chrome—½ ounce dichromate of potash
alum—4 ounces alum (potassium aluminum sulfate) plus 1 ounce cream of tartar

When using iron, I boil the wool in the dye for half an hour, remove it, stir in the ferrous sulfate and cream of tartar, replace the wool and boil gently another half hour. All other mordants are applied in advance in dyeing.

Here are some of the varied results I have achieved with the four mordants:

Figs (*Ficus carica*)—yellow. Fresh young leaves are used. Tin gives the brightest yellow; chrome mordant, dullest.

Rooibos or rooiblaar (*Combretum apiculatum*)—yellow and brown. Freshly chopped living bark is best (dried bark gives duller colors). Iron gives a deep, rich brown; the other mordants rich brownish yellows.

Buhle

Flowers of hibiscus (*H. rosa-sinensis*), with different mordants, give brown, gray, purplish tones, and yellow. If the calyx is left on, the dye becomes rich olive green.

Logwood (*Haematoxylon campechianum*)—yellow, brown, black. Alum gives an insipid yellow, but it blends well with the other colors—near-black from iron, gray brown from tin, and deep rich brown from chrome.

Hibiscus (*Hibiscus rosa-sinensis*)—brown, gray, yellow. Only the flowers are used, either dried or fresh. If calyx and stalk are left on, the color becomes a rich olive green. Tin gives brown; iron, numerous shades from lavender to dark purplish gray; chrome and alum, tones of yellow in a similar range.

Walnut (*Juglans regia*)—brown tones. Dried husks are used. Dark, medium and light brown have been obtained with tin, iron and chrome, respectively. Logwood chips added give a rich dark brown. ✦

MOROCCAN DYES

M. F. Monnier

IT IS only in small places and in isolated regions that plants are still used for dyeing in Morocco. Yet a few are cultivated for their coloring matter. Along the Draa, a southern river, there are tribes that still are using primitive methods to extract a dark-blue dye from indigo (*Indigofera tinctoria*), which they apparently received long ago from Asia. In Morocco it grows as a biennial herbaceous plant; elsewhere it is generally a shrub.

Safflower (*Carthamus tinctorius*), likewise originally from Asia, is cultivated in that same region, also south of Marrakech, in the west. A poppy-red coloring matter extracted from the flowers is used for dyeing silks and cottons, and for the manufacture of rouge.

Hodge

A famous dye of antiquity is henna (*Lawsonia inermis*), a dry-land shrub of tropical Africa, Australia and parts of Asia. The coloring comes from the leaves which are dried, powdered and made into a paste.

Henna (*Lawsonia inermis*), known and used from earliest times, is both a native and a cultivated plant in Africa. In Morocco it is grown in Doukkla and in several oases of the Souss, near Tunis, and the Draa.

While the madder (*Rubia tinctorum*) of world-wide usage is a Eurasian plant, the other species of *Rubia, R. laevis* and *R. peregrina,* are native to Morocco. Cultivation of the natural colonies there provides a small business.

Weld (*Reseda luteola*), whose natural range extends around the Mediterranean, is found wild in the sandy soils along the Moroccan coast. Its use as a yellow dye for wool, however, has virtually disappeared.

Daphne gnidium, an ornamental shrub with small pinkish flowers that are fragrant and long-lasting, abounds along the coast. Its leaves, when boiled, give a greenish-yellow color to wool that has been mordanted with alum.

Orseille (*Roccella tinctoria*), a lichen which is widely distributed and extensively used for dyeing, grows on coastal rocks in southern Morocco. A deep red coloring, used for dyeing carpet wool, is extracted from it there. ✦

OLD-TIME METHODS USED IN TANNING

In the ancient city of Fez today one can see "a tannery courtyard like those in ancient Alexandria, where tanners stand up to their thighs in an evil-smelling mixture of pigeon dung and pomegranate skins," according to June Goodfield, writing in the *Manchester Guardian Weekly,* May 28, 1964. ✦

HOME DYEING IN GREECE

C. G. Macris

IN isolated mountainous sections of Greece, such as northwestern Thessaly, western Macedonia, and adjacent Epirus, on the west, dyes are still prepared from plants as they were in the past. Most of the plants grow wild, but some are cultivated.

The classic dyes are still in use: madder, woad, weld and fustic, the last from the smoke-tree (*Cotinus coggygria* or *Rhus cotinus*). Instead of the saffron crocus (*Crocus sativus*) for yellow, the Greeks today use two closely related species, both also fall flowering: *C. cartwrightianus* and *C. tourneforti.* Such familiar plants as onion, walnut, pomegranate and nettle are sources of dye.

Roots of alkanet (*Alkanna tinctoria*) give red. The Cretan barberry (*Berberis cretica*) provides yellow for both wool and silk. This is the only native barberry in Greece. All parts of the plant, including the root, may be used.

The reddish wood of goat willow (*Salix caprea*), a Greek native, is valued for dyeing. While the flowering ash (*Fraxinus ornus*) may be used in Greece, the bark of *F. excelsior,* a much less common tree found only in the mountains, is known to yield a non-running blue-black color. Dyer's buckthorn (*Rhamnus tinctoria*), which grows sparsely as a shrub, has berry-like fruits that color cloth green or yellow. The dry, winged fruits of black alder (*Alnus glutinosa*) make blue ink; the bark dyes wool and cotton black and is widely used.

A yellow dye is pressed from the flowers of wild calendula (*C. arvensis*). Red is provided by the roots of *Onosma echioides* of the Borage Family and by the whole plant, especially the seeds, of *Peganum harmala,* a rue relative. Two gypsyworts, *Lycopus europaeus* and *L. albus,* aquatic species of the Mint Family, are gathered for the dye pot. An unusual plant used in Greece is the fungus *Polyporus hispidus* (also known as *Boletus velutinus*), which dyes wood and leather chestnut brown. ✦

In southeastern Europe, where the plant is native, roots of *Onosma echioides* are used for dyeing red. In the United States, it is seen occasionally in rock gardens.

Buhle

YUGOSLAVIA

OLD RECIPES, RECENT TESTS

A study of dye plants formerly used in Bosnia and Herzegovina

Hilda Ritter-Studnicka

Buhle

The European flowering ash (*Fraxinus ornus*) has long been an important dye plant. Bark and leaves are still used in Mediterranean countries with an iron mordant to give black.

IT has been disappointing to craftsmen that the lovely harmonic colors of vegetable origin are vanishing, being replaced by the synthetic dyes, which give color cheaply without the effort of collecting, cultivating, drying and other preparation. Very few people in Bosnia and Herzegovina nowadays know how to dye with natural products. In investigating dye plants, I have therefore had to rely largely on information gleaned from country people and from 19th century literature, supplementing this by testing some of the early recipes. Certain of the dyes mentioned were used to color paper for Mohammedan books and other religious works in pastel blue, green, pink and so. Alum water was also used for coloring paper.

For testing these recipes of another day, the following method was used: Equal parts (10 to 20 grams) of sheep's wool and dried plant material were boiled one-half hour in one-half to one liter of water. The mordants used were alum and iron sulfate. When iron sulfate is used with plants containing tannin, the result is black.

Some of the old recipes mention winestone (cream of tartar), oxalic acid and tin salts as mordants, but these were used by commercial dyers, as was kermes, the dried female shield-louse (*Kermes ilicis*).

The majority of the plants used by private dyers give a yellow dye. Bark and leaves of wild apple trees (*Malus sylvestris*) yield yellow and orange dyes. The leaves alone give honey yellow. Birch leaves (*Betula verrucosa*) were much used in olden times for a straw yellow. One kind of yellow dye for paper came from leaves of almond (*Amygdalus communis*). They were likely also used on yarn. Yellow tones can also be derived from the bark and wood of mulberry (*Morus alba*).

Flowering ash (*Fraxinus ornus*) is well known in Bosnia and Herzegovina and its bark and leaves are still in use here and there as yellow dye material. A long-lasting golden yellow is obtained from the smoke tree (*Cotinus coggygria*, formerly called *Rhus cotinus*). Until quite recently, because of their high content of tannic acid, leaves of this plant were also used in tanning. The hazelnut (*Corylus avellana*) can produce yellow with its leaves and bark, but experimentally it was not satisfactory. Our tests with leaves gave lemon yellow. Tests with elder (*Sambucus nigra*) gave the same result.

In a village near Sarajevo, paper has been colored with elder leaves. With almonds added, clear green was obtained.

Direct green, it was said, could be obtained from coltsfoot (*Tussilago farfara*) and "Cotula fetida" (*Anthemis cotula*). A decoction of coltsfoot certainly resulted in green coloring matter, but our experiments with cotula, even with the addition of ash, resulted only in yellow. There is a record of St.-John's-wort (*Hypericum perforatum*) giving a yellow color, but a dye test yielded for us a beautiful green.

Some recipes mention yellow berries, apparently various species of *Rhamnus,* the buckthorn.

In the southern parts of our country the well known dyer's broom (*Genista tinctoria*) is represented by *G. ovata*. The similarity between the two plants made us sure that the local *G. ovata* had been used, and our tests with it give a wonderful chrome yellow.

With the exception of *Sambucus nigra,* which was used to color paper blue, no native plant of Bosnia and Herzegovina produces blue. It is even possible that *Sambucus nigra* has been confused with the dwarf elder, *S. ebulus*. In neighboring countries like Montenegro, berries of this are used for making ink.

While henna, from *Lawsonia inermis*, is still used today as in ancient times for coloring hair and nails, garden balsam (*Impatiens balsamina*) is made into a paste and used as hair coloring in some places. The native alkanet (*Alkanna tinctoria*), of the Borage Family, is often confused with henna. Other members of the Boraginaceae represented in our local flora include *Cynoglossum, Onosma* and *Lithospermum*. The dye content of their roots is easily detected and is known to have been used in Croatian dye houses.

The main source of red has been madder (*Rubia tinctorum*), which has been cultivated. The similarity of common names leads us to believe that related plants in the Madder Family, as *Galium mollugo, G. aparine* and *Asperula tinctoria* were also used.

There is a report that the bark of whitethorn (*Crataegus monogyna*), also forest mint (*Mentha sylvestris*) gave a red color. Research has shown that it was not a mint, but wild marjoram (*Origanum vulgare*) that contains a reddish color. It is still used in dyeing.

Also in current use is the walnut (*Juglans regia*) for browns.

Among other plants once used for dyeing in our area are colchicum (*C. autumnale*), white hellebore (*Veratrum album*), *Serratula tinctoria,* of the Composite Family, and the plum (*Prunus domestica*), the bark of which provided black. Bark and leaves of the flowering ash (*Fraxinus ornus*) and the alder (*Alnus glutinosa*) were also used for black, with iron sulfate or iron filings used exclusively as a mordant. In neighboring countries, bark of blackthorn (*Prunus spinosa*), English oak (*Quercus robur*), and shrub maple (*Acer tataricum*), as well as leaves of barberry (*Berberis vulgaris*) were also used for black.

Some dye plants used in this region were imported even in early days: species of *Caesalpinia* under the names of logwood and "American redwood"; turmeric (*Curcuma longa*); fustic (*Chlorophora tinctoria*), and indigo. It is probable that woad (*Isatis tinctoria*) was also used for blue. A logwood relative (*Haematoxylon brasiletto*) is still used for coloring Easter eggs. ◆

ENGLAND

DYEING YARN SPUN FROM HAIR OF SAMOYED DOGS

Dorothy B. Luke

Scholtz

Hand-spun, natural-dyed Samoyed yarn was used for this hand-woven fabric. Dyes used were English madder (*Rubia peregrina*) for rose-color, indigo (powdered) for blue, dyer's greenweed (*Genista tinctoria*) for yellow, and these last two together for green. The warp is of Shetland wool.

MY specialty lies in the dyeing and weaving of hand-spun yarn from the combings of my home-bred Samoyed dogs. So far as I know, I was the first to attempt this, when wool was rationed during the last war. I do, however, also spin, dye and weave sheep's fleece, and—until recently, while living in Somerset—kept half a dozen Dorset Horn sheep largely for this purpose.

The yarn is spun on a Scottish wheel some 150 years old, or—for demonstration purposes—on a small Shetland wheel which packs easily in a car.

The natural dyes I use are mostly gathered from the hedges and fields of the countryside. Some are, however, from foreign plants such as logwood chips and indigo (which produces a better blue than any other). Cochineal is also purchased.

Generally I first apply a mordant on the well-washed yarn, in order to prepare it to take and hold the color. This is not necessary, however, when dyeing with lichens, walnut hulls or indigo. Of the available mordants, alum is the most usual, being the least expensive, producing the clearest tones, and proving very reliable. Others are bichromate of potash, iron (ferrous sulfate), tin (stannous chloride) and copper sulfate. Skeins of yarn, each treated with a different mordant and then dyed in the same dye bath, are likely to produce different, and sometimes startlingly different, colors.

Home dyes which I have frequently used, with a rough idea of the resulting colors, are these:

Yellows: Dog's mercury (*Mercurialis perennis*)—greenish yellow, becoming almost blue with long boiling; young birch leaves (*Betula alba*)—daffodil yellow; young bracken (*Pteridium aquilinum*)—almost mustard color; dyer's greenweed (*Genista tinctoria*)—bright yellow.

I also obtain yellow from privet, heath, ling, onion skins and weld.

Tones of red are obtained from birch bark (*Betula alba*); wild English madder (*Rubia peregrina*)—a very soft rose color; and a bright yellow lichen (found on old roofs) which, when mordanted with chrome, gives a dusty pink.

Plants which dye blue include, besides dog's mercury, elderberries, privet berries, whortleberries and woad.

Larch needles (*Larix europaea*) picked in autumn give brown; walnut husks, (green only)—shades of brown to amber; elderberries (*Sambucus nigra*) with alum give violet; with alum and salt, lilac.

Of the foreign dyestuffs, available in dried or powder form from a good drysalter [druggist], indigo produces quite the best blue and therefore green also (with a yellow), cochineal will give sugar pink, deep red, mauve or purple according to the mordant used and the combination of another dyestuff. Canadian logwood, turmeric, fustic and kermes (the last, like cochineal, being an insect dye which also produces red) are among many others.

I have often found that natural dyes scarcely change in color over many years, even when exposed to sun. ✦

RECIPES FROM EIRE

Lillias Mitchell

Weld, Dyer's Mignonette **Yellow; old gold; green**

(*Reseda luteola*)

Look for weld in waste sandy places. Gather when it is in flower in June, pulling it up by the roots. Hang up by the roots to dry before using.

Alum mordant for weld:

2 ounces alum to 1 pound wool
¾ ounce cream of tartar

Dissolve alum and cream of tartar in a little boiling water. Add warm water and enter wet washed wool. Raise temperature to boiling point, taking one hour, simmer for one hour. Wash wool in warm water before dyeing.

For old gold: Use chrome instead of alum.

Dyeing method for weld:

4 ounces weld to 1 pound wool

Break up stalks and put them in a muslin bag. Cover them with a little water for the dye bath. Add a pinch of salt to make the color more vivid. Add warm water and enter wetted, washed yarn. Raise temperature to boiling point, taking one-half hour, and simmer for one hour. Take out yarn, shake it, soap wash and hang up to dry.

Weld's yellow color gives a good green with indigo dye.

Gorse **Yellow**

(*Ulex europaeus*)

Gather the flowers in June.

Alum mordant for gorse:

4 ounces alum for 1 pound wool

Dissolve alum in a little warm water. Add more water and put in wool. Bring to boil and simmer for an hour. Rinse well before dyeing.

Dyeing method for gorse: Simmer gorse flowers in a little water for ten minutes. They may be put directly into the dye bath or tied inside a muslin bag. Add more water and put in the wool. Simmer for one hour. Wash with soap, rinse, and dry.

Bracken **Light green**

(*Pteridium aquilinum*)

Mordant wool with alum.

Simmer young bracken tops for 20 minutes, put in the wool and simmer for 40 minutes.

Onion **Gold**

(*Allium cepa*)

Mordant wool with alum.

Simmer onion skins for 20 minutes, put in the wool and simmer for 40 minutes.

Broom **Pale green**

(*Cytisus scoparius*)

Mordant wool with alum, using 2 to 4 ounces, according to the depth of color desired. (More than 4 ounces is likely to make the wool feel sticky.)

Simmer broom flowers for 20 minutes, either loose in the dye bath or in a muslin bag; put in the wool and simmer for 40 minutes. Wash with soap, rinse, and hang to dry.

Crottle (a lichen) **Brownish red**

(*Parmelia saxatilis*)

Lichens are gathered off rocks during July and August.

4 ounces crottle
⅛ ounce acetic acid
1 pound wool

No mordant is needed.

Fill dye bath with alternate layers of crottle and wool, and fill up bath with warm water, adding ⅛ ounce of acetic acid per pint of water. Simmer slowly for three hours. Lift out wool, shake well and wash in warm water.

By using another lichen, *Parmelia omphalodes*, and following this same method, a deeper color can be obtained. ✦

EIRE

FUCHSIA FLOWERS FOR DYEING TWEEDS

The hardy fuchsia (*F. magellanica*) has spread from gardens to roadsides and walls throughout Eire, as is shown at the right. In a single small shop, The Old Spinning Wheel, at Clifden, Connemara (Galway), on the west coast, fuchsia flowers from these naturalized plants are used for dyeing tweeds. The rose-colored corolla gives one tone of reddish purple, the purple calyx another. The two are often woven together for a richly blended and unusual tweed color combination.

Renshaw

TWO NOTES FROM GALWAY

In Galway, the only plant we use now for dye purposes is a lichen that grows on the rocks near the sea. When used for dyeing tweeds, the cloth comes up the browns of grouse or partridge—admirably suited for shooting jackets.

The man and wife who extract this dye are heading for 80 years; so very shortly their work will be a museum art.

—Pádraic O'Máille

For a method used in the west of Ireland these are the directions followed in Galway:

1 pound of lichen to 1 pound of wool

Boil the lichen slowly in water for a few hours. Allow it to cool, then add the wool. The whole is then boiled until the wool has taken on the desired tone of brown.

—Michael E. Mitchell

SCOTLAND

DYEING WOOL IN THE OUTER HEBRIDES

Winifred A. Shand

IN THE various islands which make up the group known as the Outer Hebrides, off the west coast of Scotland, the woman dyeing wool once had to use vegetable dyes, as they were the only colouring matter available. Her choice was limited to those plants which were indigenous to the area in which she lived. As there are no trees or shrubs, she was confined to using roots and flowers and experimenting with what she could collect. It has occurred to me that the various tartans may have been worked out with a view to what dyes were available in the part of the country owned by that clan. The tartan of Macdonald of Clanranald and Macleod of Harris are mostly green and red with a little yellow, black and blue, while the Macleod of Lewis is mostly yellow with red and black. All these colors are available in the islands and easily gathered in quantity. Blue is the only one not indigenous, so indigo was used, presumably brought from India and Burma by the islands' seafaring men. It was sold in lump form by most of the small merchants in the islands right up to the end of the First World War. When the Germans found out how to make a synthetic blue dye, all the indigo plantations in the East fell out of commercial use, the people of India growing only enough for their own use. Some of the spinners in the Hebrides still have a precious lump of indigo which they guard as if it were gold! Wool dyed with indigo weathers into a lovely shade but does not fade like the synthetic dye, which turns into a dirty gray.

The various plants and roots have to be gathered at different times of the year, and the quality depends greatly upon the weather of the previous season as well as the present one. If there is little sun or if the summer is too dry, the roots will carry much less dye. If the roots are to be used, the dye plants are best gathered before flowering as the dye will then be strong in the roots.

With waterlily (*Nymphaea alba*), used for dyeing black, the "roots"—that is to say the thickened rhizomes—must be gathered in summer when the lochs are shallow, so the dyer can reach them. Having located a rhizome with one's toes, for they are well imbedded in the mud at the bottom, one has to break the sucker roots which hold it down, taking care not to break the rhizome, as it "bleeds," and much of the dye is then lost. This means "guddling" with one hand and arm below the surface, one's face on a level with the water, and feeling one's way, for the silt gets all stirred up. This process disturbs all the midges and clegs (the Scottish horse-fly), which promptly set out to attack the gatherer. One wants to gather the largest possible pieces, but if the summer has been wet, only young rhizomes can be reached, and these produce only a pale gray.

Locality has always counted much, and one islander who still does vegetable dyeing told me that when she lived in South

Uist she found that one sack full of the roots of ladies' bedstraw (*Galium verum*) was sufficient for one dyeing, but when in Barra, less than 25 miles south, she had to collect two sacks to get the same quantity of color. The weavers and spinners in the north end of South Uist used to come right down the 20 odd miles to the south to gather the lichen called "crotal" (*Parmelia saxatilis*), as the rocks there come down almost to sea level and produce crotal with a much richer color.

Black is a dye much used by the island folk for their clothing right up to the present day. Everything, including gloves and stockings, is black for "Sunday best" in Harris and Lewis, and the young women in the area known as "Point" still wear the black head shawl all day, so plenty of black dye was wanted in the olden days. South Uist is the only one of the islands where waterlilies grow in any quantity, but meadowsweet (*Filipendula ulmaria*), iris (*Iris pseudacorus*) and dock (*Rumex crispus*) abound, and the two latter can be gathered and stored.

When dyeing with vegetable dyes was much used, the women were digging up the lady's bedstraw roots in such quantity that sand which the roots held together was being blown away, with consequent soil erosion to the detriment of the "machair" (common grazing ground on the west side of the islands and very fertile). So the women were forbidden to gather the roots, and the penalty for doing so was death. There is no need for that threat nowadays, as few use vegetable dyes.

The dyeing is mostly done out of doors, for it is a messy and tedious business and plenty of water is needed. The best results are obtained when the boiling is done over a peat fire in the open, for this produces a slow, steady heat, and the ash remains hot for hours. I notice that most of the recipes which I have collected and tried out say two hours for boiling the plant parts and half an hour with the wool. Some of the women used to put a potato in the pot with the boiling dye, and when the potato burst the dye was ready.

Roche

Rhizomes of the yellow-flowered *Iris pseudacorus*, found in wet places, give a black dye that is much in demand in the Outer Hebrides.

Nothing is so gentle to the wool as dyes made from plants. One dyer told me that she considered wool a natural growth, and flowers and roots also are natural growth, the two complementary to each other, and I see her point. She is also a firm believer in using urine for fixing and clearing the color of the dyed wool. Some people declare that that is the cause of the famous Harris tweed smell, but the real cause of that is that the wool has been dyed with the black or gray lichen, which, unlike the other medium, remains in the cloth as long as one strand of wool is left!

(*For recipes from the Outer Hebrides, see the next two pages.*)

Recipes from the Outer Hebrides

The Gaelic name used in the islands appears in parentheses immediately after the common name.

Heather (Fraoch) **Various colors**
(*Calluna vulgaris*)

For green, use young heather tips which have not flowered. Boil for two hours, remove heather and boil wool for half an hour with a little alum.

For yellow: Take plants in full flower. Boil plant for one hour, remove and boil wool for half an hour.

For purple: Use only tops of heather. Boil for two hours, remove tops, add 1 ounce alum for every pound of wool, and reboil.

For brown: Use the same method as when in full flower, but gather the plant when flowering is over.

Ladies' Bedstraw (Bun an Ruadh)
(*Galium verum*) **Tartan scarlet**

Dig up whole plants when the flowers are out and leave them spread out for several days to dry indoors. The roots can then be easily picked out and cleaned.

Meanwhile, wash wool in alum and dry it.

After washing the roots thoroughly, chop them very small. Use plenty of roots and put them in a big pot with water. Boil and strain the liquid until it is perfectly clear. Let it cool till it is of hand heat, then put in the wool and boil for at least two hours. Wash wool in salty water for half an hour and rinse in tepid water. Spread out on rocks to dry.

For crimson: Add chrome to the liquid.

For plum-color: Add copperas to the last boiling of the wool, or put in a handful of copper coins.

Rue (An Ruadh Lus) **Red**
(*Ruta graveolens*)

Use the roots, boil for two hours then boil wool in the liquid till the desired color is obtained.

Dandelion (Bearnan Bride) **Magenta**
(*Taraxacum officinale*)

Use whole plant, boil for two hours, remove plant and boil wool for half an hour.

Rickett

Yellow is easily obtained from rhizomes of bracken (*Pteridium aquilinum*) when mordanted with chrome. This fern covers wide areas in the wild in many parts of the world.

Buttercup (Buidheag) **Purple**
(*Ranunculus acris*)

Boil tips of plants with wool till of desired color, then add baking soda.

Sundew (Lus na Fearnaich) **Yellow**
(*Drosera rotundifolia*)

Boil sundew with ammonia. Remove plant and boil wool in liquid for half an hour.

Bracken (Bun Rainich) **Yellow**
(*Pteridium aquilinum*)

Boil roots for two hours. Remove roots and add a little chrome. Boil wool for half an hour.

Ragwort (Buadhalan Buidhe) **Yellow**
(*Senecio jacobaea*)

Boil the whole plant with a little alum, strain liquid and boil the wool in it until the desired color is reached.

Knapweed (Cnapan Dubh) **Yellow**
(*Centaurea nigra*)

Boil whole plant—tops and roots—with a little alum and the wool till of desired color.

Reed or Rush (Cuile, also Rabhagaich)
(*Juncus*) **Green**

Gather the pinkish flowers of the rush,

chop them and boil slowly for two hours, then allow to cool. Mordant the wool with 4 ounces alum or 1 ounce cream of tartar before placing in the liquid.

Waterlily roots (Bun an Lilidh) **Black**

(*Nymphaea alba*)

Scrape and scrub roots until clean, then beat and pound with a wooden beater till soft. Boil and strain until liquid is clear. Place wool in liquid and boil till a rich brown, then add copperas for final boiling.

Dock roots (Bun na Copaig) **Black**

(*Rumex crispus*)

Wash the roots well, boil for two hours. Add a little chrome and boil wool in liquid for half an hour.

Meadowsweet roots (Lus Cuchulainn) **Black**

(*Filipendula ulmaria*)

Collect roots in July, wash and boil. Strain the liquid till clear, then boil the wool in it till the color required is obtained.

Meadowsweet stalks and leaves **Blue** (Lus Cuchulainn)

(*Filipendula ulmaria*)

Boil stalks and leaves together for two hours. Strain, then boil wool in liquid till navy blue is obtained. Boil with roots of sorrel (*Rumex acetosa*) to fix the color.

Lump Indigo **Blue**

Old recipe from Outer Hebrides

Boil wool with onion skins till clear yellow, then let wool dry. Have an old pail filled with urine at least two weeks old, or until skin forms on top. Use wooden tub for dyeing. Put lump indigo in a muslin bag, heat the "bree" to hand warmth by placing a hot stone in it. Squeeze in the blue bag. Wet the wool and place in the liquid. Cover the wooden vessel and place where it will keep warm. After 24 hours take the wool out and *shake* it, do not wring or squeeze. Heat the stone again in the fire and place in bree till hand heat again; replace wool and cover as before. Repeat shaking and reheating every 24 hours for at least seven days. For navy blue, 11 to 21 days are required. Fix with boiled sorrel roots as rinsing water, but do not boil the bree as it loses its properties.

Other dye plants and their colors used in the Outer Hebrides include the following, the Gaelic names appearing after the italicized botanical names:

Green: Buds of bracken (*Pteridium aquilinum*)—Bun Rainich

Yellow: Bog-myrtle (*Myrica gale*)—Roid; St.-John's-wort (*Hypericum perforatum*); teasel (*Dipsacus fullonum*)—Lus an Fhucadair; monk's rhubarb (*Rumex alpinus*)—Lus na Purgaid

Orange: Bramble (*Rubus*)—Smeuran

Brown: Walnut (*Juglans regia*)—Geinn

Brown, purple or blue: Blaeberry or whortleberry (*Vaccinium myrtillus*)—Lus an Deare

Black: Oak (*Quercus robur*)—Darach, use bark and acorns; alder (*Alnus glutinosa*)—Fearna, mordanted with copperas

Black or deep fawn: Iris (*Iris pseudacorus*)—Bun Sealasdair

Lichens Used in Dyeing Wool

The lichen known as crotal, or crottle (*Parmelia saxatilis*) grows on rocks. Gather it on a windless day when it is wet, preferably in March or November. It will keep indefinitely when dry.

For orange: Wet the wool. Line a vessel with black lichen, then "ply" in layers of wool and lichen, topping it off with lichen. This is a "contact" dye and the dye is infused into the wool. Fill the pot with water till lichen at top is covered. Boil, on a peat fire if possible, as it gives a slow steady heat, until required depth of color is seen on wool under top layer of lichen. Remove pot from fire and stand it outside for 24 hours to cool. Drain off the water and shake the wool so that the wet lichen drops out, and lay it out on rocks to dry.

For deep "Highland cattle" brown: Follow the same method, using gray lichen gathered from the hills.

For rosy pink: Use yellow lichen (*Xanthora parietina*) which grows just above the high tide mark on rocks. ✦

USING PLANTS FOR DYES IN NORWAY

Sophie Sverdrup

Translated by Inger Tormundsen

PEOPLE desire to be handsome, have handsome clothes and have beauty around them. Colors have a lot to do with beauty. The spinning materials we get from plants do not have much color, only gray and dull yellow. Some of those from animals are nice shades of black, brown, gray and blue gray, but most wool is white. Dyes from plants were long used for brightening these materials, but after about 1850, when synthetic colors were adopted, the use of vegetable dyes was reduced until it was almost entirely forgotten.

Plant coloring, however, is still important. The chemical industry makes all kinds of soft, fine colors and states that these have better fastness than the dyes from plants, which are criticized for fading. (One can test colors by hanging yarn in a window for a few months.) But the dyes from plants have the advantage of fading only a little at a time, if at all; they do not turn into different colors.

Methods of dyeing vary. Solution dyeing is probably the oldest method. In this, the plant parts go through a fermentation process and the material to be colored lies in the dye solution (which is kept lukewarm) for a long or short period of time. More often, the plant parts are boiled and the material is boiled in the resulting color bath. To get most colors one uses a mordant, which is a link between the color and the material. This is often alum, tartar, iron vitriol (copperas), copper vitriol, or something similar. Blood and urine have been much used in dyeing.

The boiling kettle has influence over the color. Copper kettles are best; iron kettles are good for some colors. For example, if heather is boiled in a copper kettle, a beautiful deep yellow color will result. If an iron kettle is used, the color will be greenish.

Different textile materials absorb colors differently. Fibers from animals, as wool, hair and silk, absorb color much more easily than fibers from plants—flax, hemp and so on.

Colors from Flowering Plants

Red

Bedstraw (hvitmaure: *Galium boreale*), which grows along the roads and in uncultivated fields, has been used since olden days. Its roots give a yellow-red color, soft and very beautiful. It blooms in July, is 30 to 50 centimeters (12 to 20 inches) high, and has small white flowers with a sweet, luscious scent. The roots are branched and are as thick as a knitting needle. When the bark is scraped away, they are reddish yellow. Roots should be collected in spring before flowering starts or in fall when they have been supplied with nutrition. After they are cleaned of earth they are dried. Before being used they are ground or finely cut.

The lichen *Ochrolechia tartaria* also gives a red dye (see page 68).

Blue

We have no native wild-growing plants that give blue color, but woad (*Isatis tinctoria*) has been cultivated in Norway, and it now grows wild in some places.

Yellow

We can get yellow from so many leaves and plants that we could dye all the wool in Norway yellow, if we wished to. The leaves of birch, willow, alder and aspen give different yellow and yellow-green colors, used either fresh or dried. They have the most strength of color when

Translated and condensed from a chapter on dye plants by Sophie Sverdrup in *Nyttevekst Boka*, published in 1942.

Buhle

Leaves of tansy (*Tanacetum vulgare*), if plucked from the plant before the yellow button-like heads of flowers appear, will give cloth or yarn a clear yellow-green color.

fully grown, about St. John's Day (June 24) or a little later. They can be used for drying as long as they are green. They should be picked in good weather, laid out in the shade in thin layers, and stirred a little every morning and evening. Everything, in fact, which is to be dried for coloring, should be kept in the shade. When the leaves are thoroughly dry, they may be stored in paper bags in a dry place.

Heather (røsling: *Calluna vulgaris*) is common over the whole country on heaths, marshes and knolls. It gives yellow and bronze-brown colors. By adding iron, the color will turn blue-green; if blue is also added, it becomes deep green. Heather can be used the whole year round. For drying it is preferable to take it when it starts blooming. Either the whole bush or the young branches and twigs may be used. It dries easily.

Sweet gale (pors *or* post: *Myrica gale*) is a small bush which is easy to recognize because of its good scent. It grows in marshes and near forest lakes. It is best to collect the young branches for drying when the leaves are grown. The branches can also be gathered and used in winter. This plant gives a fine yellow color, which, like many other yellows, can be changed by adding other dye materials.

Coltsfoot (lersol: *Tussilago farfara*) blooms early in the spring. The leaves give a green-yellow color which turns into a beautiful green if copperas is added.

Lady's-mantle (marikåpe: *Alchemilla vulgaris*) bears its small modest flowers from May until frost comes. All the green on the plant can be used for coloring.

Sorrel (syre: *Rumex acetosa*) gives a greenish-yellow color. The leaves of this and other kinds of sorrel can be used the whole summer, but they are best in spring.

Chervil (hundekjeks: *Anthriscus silvestris*) grows about the whole country. Its foliage gives a clear yellow-green color.

Bearberry (melbaer: *Arctostaphylos uva-ursi*) is very similar to cranberry, both in foliage and fruit, and the leaves keep green over winter. The whole plant, except for the root, can be used all year, but it should be picked before the berries form. It gives a cloudy yellow-green color, which turns into a handsome gray when more dye is added.

Beggar-ticks (brønnsle: *Bidens tripartita*) can be found in damp places, but the plant is little known. It can be used from June until August, before or after it blooms, and either fresh or dried. It gives a strong yellow color.

Barberry (berberis: *Berberis vulgaris*), which is cultivated over the whole country, has begun to grow wild in the southern parts. For a soft red-yellow color, small twigs bearing young leaves are cut and used either fresh or dried.

Tansy (reinfann: *Tanacetum vulgare*), both cultivated and wild, grows in dry places and gives off a strong spicy smell. Before the plant blooms, the leaves can be used to give a fine, clear yellow-green color.

Dyes from Nonflowering Green Plants

Horsetail (skogsnelde: *Equisetum sylvaticum*) and other kinds of scouringrushes give beautiful grayish-yellow colors. The segmented stems with their sprays of green branches are easily picked in July and August when they are fully developed. They are easy to dry, or they can be used immediately.

Hairy-cap moss (bjønnemose: *Polytrichum*) is used on Alands Island for a grayish-yellow coloring.

Clubmosses (kråkefot *or* jamne: *Lycopodium*) of several kinds grow as trailing evergreen plants, mostly in the forests. For drying, they should be collected in the spring, but they can be used fresh all year round. They give a grayish-yellow color, but they are used mostly as a base for other colors.

Juniper (ener: *Juniperus communis*) has blue berries which provide a brown dye. The wood, bark, and even the yellow lichen which grows on junipers are also usable in dyeing.

Tree Barks Used as Dyes

Tree bark should be collected in the spring when the sap is in the trees, and it should be taken from young trees which are not overgrown by moss. Yet the branches should not be too thin. The bark is dried, and can then be kept in bags for several years in a dry place. Almost all bark contains tannic acid, so when iron salts are added, dark colors are obtained.

Some of the trees whose bark is especially valuable for dyes are: ash (ask: *Fraxinus excelsior*) for green and brown, the wood also being usable; birch (bjørk: *Betula alba*), a durable gray; apple (epletre: *Pyrus malus*), strong yellow; English oak (eik: *Quercus robur*), gray and black; bird cherry (hegg: *Prunus padus*), gray; willow (isterpil: *Salix pentandra*), brown; alder (or: *Alnus incana* and *A. glutinosa*), yellow, yellowish brown, and brownish gray, also black; rowan-tree (rogn: *Sorbus aucuparia*), gray; blackthorn (slapetorn: *Prunus spinosa*), reddish brown; buckthorn (trollhegg: *Rhamnus frangula*) bronze brown after drying for a year.

Scholtz

Bark of several species of *Prunus* is counted among the natural dyes of northwestern Europe. Pictured here is dried bark of an American cherry (*Prunus serotina*) as prepared for dyeing at Penland School of Handicrafts.

Lichens as Coloring Agents

Almost all kinds of lichen can be used for coloring. They can go directly on wool without a mordant, but some have to go through a process of fermentation before they will release their color. Many fine, subdued tones can be obtained from them. Most important is the gray stone-lichen (gra steinlav: *Parmelia saxatilis*), which gives a slightly reddish brown color, especially beautiful for backgrounds. The brown lichen (brunlav: *Parmelia omphalodes*) gives a clean dark brown; the green one (grønn steinlav: *P. conspersa* or *P. centrifuga*), about the same as *P. saxatilis,* but it is less common. These lichens grow on stones, sometimes along the coast, sometimes in the mountains.

The gray beard lichen (trådlav: *Usnea barbata*) and the black beard lichen (svartlav: *Bryopogon jubatum*), both give greenish yellow, as does hair-moss (hårlav: *Alectoria sarmentosa*). Reindeer-mosses (reinmose *or* reinlav: *Cetraria* or *Cladonia*) of several kinds give yellow to brown. The papery lichen (papirlav: *Cetraria glauca*) grows as big thin slices that look like leaves; Iceland-moss (Islandsk lav: *C. islandica*) branches and grows about four inches high.

The white stone-lichen called "korkje" (*Ochrolechia tartaria*), which is common on rocks and tree trunks, gives red or pink when fermented in urine. It was formerly an export item. ✦

NORWAY

SEVERAL COLOR TONES FROM ONE DYE BATH

Dagmar Lunde

Sweet Gale	**Yellow**
(*Myrica gale*)	(three shades)

Three different tones of yellow can be obtained from the same dye bath of sweet gale leaves. The wool is divided and all three skeins are at first dyed together. Two of the skeins then receive additional treatment separately. Here are the directions:

For 300 grams (12 ounces) of worsted divided into three skeins, use:

40 grams (1.6 ounces) of alum for mordanting
250 grams (10 ounces) of sweet gale leaves

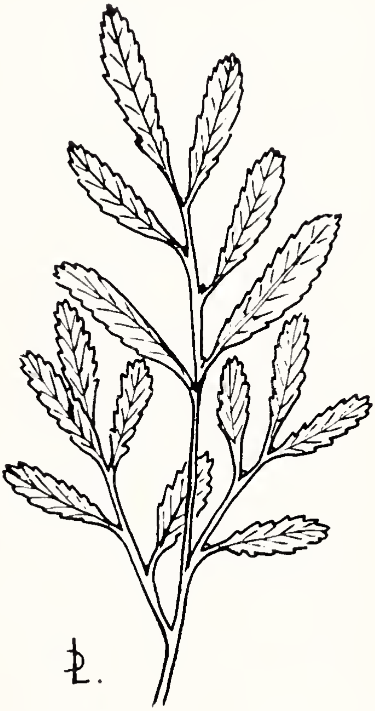
Mordanting

Put the clean wool in lukewarm water in an aluminum kettle for two or three hours. Stir the alum in warm water until dissolved. Add enough water for a mordanting bath and heat slowly. When temperature reaches 40 degrees C. (104 degrees F.), put the wet wool in the kettle and simmer for one hour. Let cool in the kettle.

Dyeing

1. Cover fresh leaves with cold water and let boil for one hour. (If dried leaves, soak for a night beforehand.) Strain and return the ooze to the same kettle. Add enough water for a dye bath and heat slowly. When temperature reaches 35 degrees C. (95 degrees F.) drop the worsted in the dye bath and let simmer for 45 minutes. Remove the skeins from the dye bath and hang up. They will be a golden yellow.

2. Pour half of the yellow dye bath into a kettle and add 5 grams (.2 ounce) of copper vitriol. Stir until it is thoroughly dissolved. Add water. With temperature at 40 degrees C. (104 degrees F.) drop one skein of yellow yarn in the kettle and let it simmer for 15 minutes. Remove the wool and immediately hang up. The color will have changed to a warm yellow brown.



Sweet gale (*Myrica gale*) is favored for the several tones of yellow it can produce. Only the leaves are used.

3. Pour the other half of the yellow dye bath into a kettle and add 5 grams (.2 ounce) of iron vitriol. Stir until it is thoroughly dissolved. Add water. At 40 degrees C. (104 degrees F.) drop the remaining skein of yellow yarn into the kettle and let simmer for 15 minutes. Remove the wool immediately and hang up. The result will be a cold yellow green.

When all three colors are finished the wool must be washed and rinsed. Hang to dry in a shady place. The three tones can be beautifully blended. ✦

RECIPES FROM LAPPLAND

Lisa Johansson

Translated by Kerstin Gustafsson

Spruce **Camelhair-color**
(*Picea abies*) *For wool or cotton*

Cut twigs from spruce (without lichens), chop them and let them simmer for 12 hours. Use an aluminum or enamel kettle. Add the yarn on top, but keep it submerged in the bath. Hold the temperature at 80 degrees C. (176 degrees F.). Stir to get an even color. When the desired shade is obtained, hang the wool to dry without rinsing. You can get different shades according to the time the yarn is in the dye bath.

Bearberry **Green**
(*Arctostaphylos uva-ursi*)

Use the fresh plants, rinse them and boil four hours. Add alum and leave the kettle on slow heat. Strain and add iron vitriol. Test the color; if right, add the yarn and leave it in the bath for at least one hour. Stir carefully. Rinse and hang it up to dry. If you add blue vitriol (copper sulfate) you get a blue-green color.

Onion peel **Yellow; green; moss green**
(*Allium cepa*)

Several strong and beautiful colors can be obtained from onion peel. You must experiment with the measures and weights.

For yellow: Use an alum mordant. Simmer the onion peel in water. Put wetted material into the dye bath and continue simmering until you have the right color.

For green: Follow the directions for yellow, but use ferrous sulfate and copper sulfate as the mordant.

For moss green: Follow directions for yellow, but add iron sulfate to the alum mordant.

Mountain-cranberry **Red, yellow**
(*Vaccinium vitis-idaea*)
For wool, linen and cotton

Use stems with leaves of this plant (which is known to us as lingonberry) gathered in summer. Boil two hours, add alum. Now add the yarn, stir and keep it in the bath for one hour or until desired shade is obtained. Rinse and hang it to dry.

Dock **Light grayish-pink**
(*Rumex acetosella*)

Use whole plant; place in large wooden bowl, add water and alum, and leave this to steep two to three weeks. Add yarn, stir to get even color. Leave in bath for a couple of days. Hang to dry without rinsing.

This method can also be followed with birch bark, willow, mountain-ash (*Sorbus aucuparia*), alder, fresh birch twigs (for yellow green), and yarrow (*Achillea millefolium*).

Birch **Yellowish green**
(*Betula nana*)

Cut twigs from birch and chop them into small pieces. Add water and alum and boil until the water is yellowish-green. Add gray yarn, which gives the best result. Let it simmer until the yarn has a yellow-green color.

Juniper **Oxblood brown**
(*Juniperus communis*)

Boil twigs of juniper until you get a dark liquid. Strain and add alum and tartar and baked red beets, cut into pieces. Add the yarn and stir to get an ecru color. Let stand for two days, then heat and stir for at least one hour. If the color is too light add a little copper sulfate (blue vitriol).

Horsetail **Yellow, greens**
(*Equisetum arvense*)

Yellow is obtained with an alum mordant and very little boiling.

Iron vitriol (ferrous sulfate) gives gray green, and copper sulfate gives grass green.

If the kettle is aluminum or zinc it gives a green color after two hours with or without boiling. ◆

ABORIGINAL DYES IN CANADA

Douglas Leechman

THE Indians of the British Columbia coast practiced the art of dyeing, particularly in the manufacture of the elaborate Chilkat blankets. The dyes used for this purpose were hemlock bark, which was boiled in urine or with a black mud, to provide a black; a lichen, commonly known as wolf-moss (*Evernia vulpina*), for yellow; and copper ores, boiled in urine, which gave a greenish blue. Alder bark, a dye which is used wherever this tree occurs in Canada, provided another shade of yellow or orange and was much favored on the West Coast for dyeing twilled mats and ceremonial neck-bands and crowns of cedar bark. Water-tight boxes and, further inland, coiled baskets served as dye-pots.

Turning now to the East of Canada, we find that the forest-dwelling people, in the Great Lakes region, had made much progress in the art of dyeing. Here again special factors favored the development of the craft. Being pre-eminently a forest folk they had acquired a thorough knowledge of the local flora. They made very general use of herbal remedies and had discovered the virtues, real or imaginary, of many plants, some of which are quite inconspicuous in habit. The large number of dye-plants included in their pharmacopoeia almost suggests that deliberate research in the technology of dyeing is not too bold a claim for them.

The greatest weakness in their technique is found in their limited use of mordants. The acid juices of crab-apples and other wild fruits served this purpose, but it was not until the coming of the white settlers that the Indians learned to use a copper vessel as a dye-pot and to add alum or copperas to their dyes to fix the color.

Roche

The handsome black berries of pokeweed (*Phytolacca americana*) were an important source of red dye for the aboriginal Indians of Canada.

Among the more important dyes used for various colors may be mentioned alder, bloodroot, bedstraw, lamb's-quarters, pokeweed, puccoon and sumac, all of which yielded a red dye; goldseal and goldthread for yellow; walnut for black; bittersweet for a bright orange; ash and yellow adder's-tongue for green; wild grape and larkspur for blue. Simple boiling of the goods to be dyed in a decoction of the dye-plant was the usual method employed. After boiling, the bath was allowed to cool and the dyer then rinsed the goods in water to remove unfixed dyes. If necessary a second dyeing, at times in a different color, was resorted to. Many of the colors were fugitive, but others retained their brilliance for years. ✦

(From an article on "Aboriginal Paints and Dyes in Canada" published by the Royal Society of Canada in its Transactions for 1932)

WESTERN CANADIAN RECIPES

From the prairie region

Grace Raitt

Rickett

Inner bark of white birch (*Betula papyrifera*) makes a light brown dye; it becomes green when copper sulfate is added.

WOOL must be washed first with good soap, well rinsed and entered in the dye bath while still wet. While simmering, keep lifting and stirring wool with a flat stick. I use an old copper boiler or a heavy aluminum pot for all my dyeing.

[Note that these recipes are for one-half pound of wool.—Ed.]

Lichen **Yellow; light green**
(*Parmelia manshuriea*)

For yellow:

½ pound dry lichen
½ pound wool

A mordant is not needed.

Crush dry lichen into tiny bits, put in muslin bag, soak overnight in soft water. Boil for one hour. Enter washed and rinsed wool while still wet. Simmer for one hour. Rinse thoroughly and dry.

For green: A copper sulfate mordant is used. After removing the yellow-dyed wool from dye bath, add to the bath 2 ounces of copper sulfate and stir until thoroughly dissolved. Enter another half-pound of washed and rinsed wool. Simmer until a clear pale green has been achieved, then rinse and dry.

White Birch **Light brown; green**
(*Betula papyrifera*)

Use the inner bark. A mordant is not needed.

For light brown:

1 pound bark
½ pound wool

Break bark and crush into small bits, put in muslin bag and soak overnight in soft water (rain water). In the morning boil for one hour. Enter washed and rinsed wool while still wet. Simmer for half an hour. Rinse thoroughly and dry.

For green: Use the same quantities as for light brown, but add 2 ounces of copper sulfate. Stir until dissolved, enter wetted wool and simmer for one hour. Rinse and dry.

Bedstraw **Brownish pink**
(*Galium boreale*)

Use the roots only.

½ pound bedstraw roots
1 ounce alum
½ pound wool

Crush roots, put into muslin bag and soak overnight in soft water. In the morning boil for one hour, add alum, stir until dissolved. Enter wool, simmer for half an hour or until desired color is reached. Rinse thoroughly and dry.

For a deeper shade:

¼ pound bedstraw roots
¼ pound wool
4 ounces white wine vinegar
4 quarts soft water

Soak bedstraw roots overnight. In the morning boil one hour. Add vinegar and wool which has been washed and rinsed. Boil gently one hour. Rinse thoroughly and dry away from sun. ◆

CANADA

From British Columbia

Katherine Wilson Tye

Horsetail Greenish yellow

(*Equisetum*)

Equisetum is a very useful dye plant because it not only produces a pleasing yellow color, but it also makes an excellent base for top-dyeing with another color.

In spring gather a generous basket of the bright green plant, discarding all roots. Put the plants into a granite pot filled with rain-water. Add about one-tenth the weight of mordanted wool (using standard alum mordanting method) in alternate layers with equisetum. Simmer for one-half hour, rinse well in warm water and dry in the shade.

Any of the dyed wool not used as yellow yarn should be kept to top-dye with various other plants of different colors, later in the season. The light yellowish color seems to brighten and improve other dye plants such as madder, lupine, birch leaves, tansy and many others. Top-dyeing with a small amount of indigo gives a lovely pale green.

Lungwort **Beige to deep orange brown**

(*Lobaria pulmonaria*)

This lichen is found mostly on Pacific maples in the damp forests of British Columbia, Canada. It can be picked off the ground after a storm at any season of the year. Otherwise, it is difficult to obtain as the trees are very high. It is green and limp when wet, but when dried it turns to a beige-brown. It can be hung in hemp sacks in a dry place and used at any time.

Equal weight of dried lichen gives wool a light brown color, but by increasing the quantity of lichen a deep orange-brown is obtained. No mordant is needed.

By using eight to ten times the weight of lichen to wool, one can obtain three blending colors from one dye bath. Slowly boil the lichen and wool until the orange-brown is reached; then remove the wool and enter another skein, boiling until a light brown is reached. Again remove the wool and enter a third skein; boil until a soft beige is reached.

Gottscho-Schleisner

The branching green stalks (*center*) of horsetail (*Equisetum*) impart a greenish-yellow color to alum-mordanted wool; especially good as a base dye for other colors. The reproductive stalks (*right* and *left*) are not used.

Yellow Lichen **Brilliant yellow**

(*Letharia vulpina*)

This brilliant yellow lichen of the mountains of the Pacific Northwest, found mostly on fir and pine trees above the 2,000-foot level, is one of the best lichens for dyeing wool as it gives the same brilliant yellow as itself. It can be gathered at any time of the year with equal success. It will dye a pleasing pale yellow if a little is used, and an increasingly deep yellow if a large quantity is used. It requires only a short boiling. When washed, rinsed, and dried in the shade, the wool has an almost luminous quality. It is the perfect lichen dye for the beginner. No mordant is required. ✦

IN THE UNITED STATES

Allen M. Parrott

Peach leaves **Yellow**

For a "sour" yellow color, cover one bushel of peach leaves with ten gallons of water. Allow to stand in a warm place completely covered for a week or two.

Mordant one pound of light gray wool with potash alum. After boiling, drain, wrap in a cloth and let the wool stand several days. Rinse yarn, then cook one hour with the fermented peach leaves.

Green Walnuts **Brown**

With green walnuts which have been smashed and boiled, it is possible to get a variety of browns.

Alum-mordanted yarns will become a rosy brown. Chrome-mordanted yarns will become a darker black-brown. Unmordanted yarns tend to become gray-brown. Adding a pinch of copperas after dyeing has taken place will give the brown a greenish cast.

Iron vessels should be used.

Calliopsis **Brick red**

A brick-red color can be derived from the red-and-yellow flowers of calliopsis (*Coreopsis tinctoria*).

Mordant one-half pound of wool or yarn with potassium dichromate. Drain, rinse and then boil with one-half bushel of calliopsis flowers until a dark brick red is obtained.

Note: The paler colors obtainable from the calliopsis plant are fugitive. ✦

Sue Johnson

Green Lichen **Yellow to greenish yellow**

The branched green lichen found on rocks in California gives a clear light yellow on wool when the directions below are followed. A larger quantity of the lichen (which is a species of *Ramalina*) imparts a greenish tone.

Boil 5 ounces of green lichen for one hour in water to cover, adding water as necessary. Strain through cheesecloth and have sufficient liquid to cover five to six ounces of raw wool (scoured and carded). Moisten wool and place carefully in liquid. Boil for one-half hour without stirring. Add two tablespoons cream of tartar. Boil gently for another half hour. Squeeze and dry. Re-card wool; any variations in color will then be blended.

Onion skin **Golden tan**

(*Allium cepa*)

A small quantity of onion skins will produce a golden tan. For each pound of scoured and carded wool use one ounce of skins from brown onions. Cover onion skins with water and boil for two hours, adding water as necessary. Strain through cheesecloth. Place dampened wool in liquid, being careful not to agitate. Bring to a boil and simmer, without stirring, for one-half hour. Add two tablespoons powdered alum and simmer half an hour longer. Let cool and rinse in cold water until water is clear. Squeeze and dry. Re-card wool to blend color variations. ✦

HISTORIC BUILDING, DYE-PLANT GARDEN

Forty species of dye plants and ten of textile fiber sources are grown outside the Old Slater Mill, now a museum, in Pawtucket, Rhode Island. Planted by the New England unit of the Herb Society of America, the garden is maintained by the Pawtucket Garden Club. The building was the first successful water-powered mill to spin cotton in America. Constructed in 1793, it was in operation until 1920. It now attracts many visitors (35,000 in 1963) with its permanent exhibit of the development of spinning.

FROM BOOKS OF AMERICAN DYERS

Elderberry — Lilac blue; violet purple

(*Sambucus nigra*)

The berries and leaves of the elderberry contain dyestuff. The berries give a varying color depending on the amount used and the time of boiling; a long simmering deepens the color. The berries are difficult to use. To obtain an even color, wet the wool, enter quickly and stir continually. Careful mordanting is a prerequisite.

To one peck of fruit, bruised and boiled thirty minutes, add one tablespoon of salt. Strain out the fruit before dyeing.

The depth of color may be varied by the amount of fruit used as well as the boiling time. Alum mordant produces a lilac-blue and chrome a violet purple. The colors obtained are as good as those from logwood.

Two gallons of leaves shredded and bruised give shades of yellow with both alum and chrome mordants. An old recipe says "elderberries stewed with copperas, vinegar, and alum make an excellent ink."

From THE DYE-POT by Mary Frances Davidson. Published by Author, Shuttle-craft Shop, Middlesboro, Kentucky, 1950.

◆

Rhododendron leaves — Gray

(*Rhododendron maximum*)

Use only the leaves of rhododendron, and, if possible, soak them in water overnight.

In an iron kettle boil the leaves covered with water at least two hours. Strain and return the ooze to the same kettle adding enough water to make a generous dye bath. Now, add the copperas, and when it is thoroughly dissolved add the wool. Simmer for thirty minutes.

Remove the wool from the dye bath, rinse until the water is clear, and hang the wool in the sun to dry.

Roche

Fruits of the native elderberry (*Sambucus nigra*) will give lilac blue with an alum mordant, violet purple with chrome. The leaves alone give various tones of yellow, according to the mordant.

While the leaves boil, wash your wool in a good soapsuds, rinse and leave it to soak in water until ready to use.

As long as there is dye in the water, you can add successive skeins of wool and get a nice shade, each one lighter in tone.

From VEGETABLE DYEING by Mrs. Emma Conley. Second edition revised by Mrs. Meta Lewis. Penland School of Handicrafts, Inc., Penland, North Carolina.

◆

Juniper; Red-cedar — Khaki

(*Juniperus*)

The bark, berries and twigs are all suitable for dyeing wool. Berries are commonly used and produce with this special

Juniper (*continued*)

recipe, a good khaki color. For a pound of wool proceed as follows:

Dissolve the alum, ammonium chloride, cream of tartar, and copper sulfate in 4 to 4½ gallons of soft water. Put in the wool, wet thoroughly and squeeze out the water, boil for 1 hour, and let stand in this mordanting liquor until cold, then rinse. Break up the berries, tie in a cheesecloth bag, soak in water overnight, then boil for 1 hour and add enough cold water for the dye bath. Immerse the mordanted wool in this dye extract, boil for 1 to 2 hours, and remove. Add the copper acetate to the dye bath and when dissolved, return the yarn or cloth, and boil for 15 to 30 minutes longer. Rinse and dry.

From USING WAYSIDE PLANTS by Nelson Coon. Hearthside Press, Inc., New York, third revised edition, 1960.

Buhle

The small blue "berries" which occasionally cover the branches of red-cedar trees (*Juniperus virginiana*) can be used to dye wool a khaki color.

RECIPE FROM THE BAHAMAS

Harriet S. Buchheister

Red Mangrove **Tan**

(*Rhizophora mangle*)

For silk or linen

1 pound bark from mature trees
3 quarts water

Boil the bark until the color seems right. Remove the bark from the dyebath and steep the cloth (without crowding it) until a shade darker than the desired color is achieved. Rinse several times in clear water, then add salt—a few spoonfuls—to the last rinse water. No mordant is used. The color is a rich, warm tan. ✦

Bu

Mangrove trees commonly grow out toward salt water from shorelines. The bark of many kinds can be used as a dye. Shown here is *Rhizophora mangle*, which produces a rich warm tan without a mordant.

FAMILY DYEING IN COLONIAL NEW ENGLAND

A bit of history

Martha Genung Stearns

To the early explorers along America's eastern coast, this country seems to have had a colorful fascination, according to the records they have left us. Mariners from England passing by in the spring thought New England an earthly paradise, with flowers, herbs, vines, nut trees and other valuable plants.

In surveying this new land the early voyagers were quick to recognize trees and other plants which resembled those they had known at home. What they called "the diar's shumach" was noted. This was probably staghorn sumac (*Rhus typhina*) or smooth sumac (*R. glabra*), which could easily be mistaken for the European *Rhus coriaria,* known to them as good for dyeing and the tanning of leather. They also commented on the "divers roots and berries wherewith the Indians dye excellent holding colors that no rain or washing can alter."* Reading this, we wonder if the Indians used fixatives of some kind. But other early reports indicate that, while the Indians used the red juice from bloodroot to color their faces and paint imitation blood on their tomahawks, slimy green algae from stagnant water to make a green stain, and lichens scraped from stones for yellow, these colors did not stand up for fabrics.

Henry Josselyn, who came as a sightseer and later settled in Maine, speaks of "wood-wax (*Genista tinctoria*), wherewith they dye many pretty colours." There is a tradition, however, that this was introduced by Governor Endicott 40 years before Josselyn was doing his herb-hunting; it was easily naturalized but at the time was confined largely to the neighborhood of Salem, Massachusetts. (This plant is less correctly known as woad-waxen, and is also called dyer's greenweed because its yellow coloring gives green when combined with woad or indigo.)

Buhle

Among the plants that looked familiar to North America's colonists from England were the red-fruited sumacs, like *Rhus typhina*, above, because of their resemblance to the European dyer's sumac (*Rhus coriaria*). American species of sumac became important as dye plants at an early date; also extensively used in tanning.

Seeds of Herbs for Dyeing

Anyone who has seen Mayflower II, the replica built as nearly as possible to the specifications of the original ship, must have realized what an almost superhuman job was done in packing away all the passengers with their household gear and supplies for the voyage across the Atlantic. Even in the small ships which followed during the first few years there was little space to spare. But we are told that the women brought little bags of seed with them, and it was surprisingly soon that they managed to make real homes and set up simple household arts. They planted herbs and cultivated native ones which they discovered. When they sent memorandums back to England for needed supplies, they included seed for growing woad (*Isatis tinctoria*). This blue was never as good as that from indigo, which could penetrate material with a brighter and more lasting color, but it was the native English dye plant with which they were familiar.

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*Quoted from "The Flora of Colonial Days" by Mary T. Saunders (Essex Institute Bulletin, Salem, Massachusetts, 1895).

We can well imagine that the early dyeing experiments with American plants were carried on by the trial and error method. In those days any housewife would know something of the subject, and the new continent gave the colonists many plants, barks, roots and berries which would impart good colors to their fabrics. When they found plants that were similar to those they had used before, they tried them out.

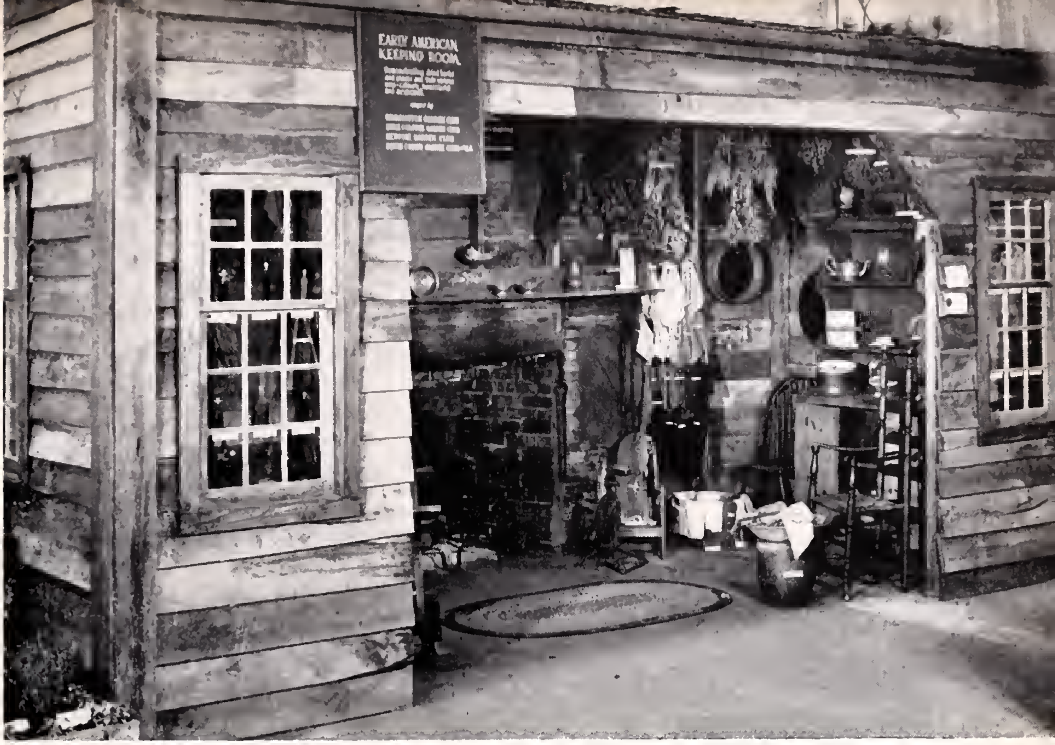
Home-made Mordants

The method was to extract the juice by infusions, but these varied in strength; the juice of above-ground parts of a growing plant would not be as strong as that of the root. And it was not enough merely to dip and soak the fabric in these juices, as the color could easily be washed out again unless some good fixative was used to set the dye. We all know that a stain caused by iron rust on a fabric can be bleached out only with difficulty. So, though ill-equipped to deal with such problems, but with mother-wit coming to the rescue, they made a metallic mordant from rusty kettles and old nails, even filings from the blacksmith's forge. Many of the early dyes gave dull browns, yellows and grays, probably because of the underlying tint from the iron mordant. These dismal shades which were so predominant were described by such depressing names as drab, snuff, liver, sad-color.

It is no wonder that our foremothers

One of the supplies required from England by the 17th century colonists in New England was seed for growing the woad (*Isatis tinctoria*) with which they were familiar as a blue dye plant. Here it is shown in flower in a garden of today.

Roche



Hugelmeyer

EARLY AMERICAN KEEPING ROOM, DEMONSTRATING HOUSEHOLD USES OF PLANTS

Dye plants were important to the American colonists. For the exhibit illustrated here, more than 50 colors and color tones were produced from natural materials in accordance with colonial practices. This award-winning keeping room was displayed by the Garden Club of America at the New York Flower Show (1954) to carry out the organization's theme of the heritage of American gardens. It was prepared by four Rhode Island member clubs: Bennington, Little Compton, Newport and South County. Culinary and medicinal herbs were also shown. The dyed materials have since appeared in more than twenty exhibits. The "keeping room" was described at the time of the Flower Show as "literally the center of the house and of its activities. There, in the winter, in front of the broad hearth, the housewife cooked, churned, washed, ironed, dyed, pounded herbs, dried them over the mantel, made infusions, spun and wove, made candles and soap, and there the family ate and often slept."

wanted colors other than these. It was all very well to use drab for working clothes, aprons and half-sleeves to draw on over their clean cuffs, but their souls longed for red, bright blue and, somewhat strangely, purple.

As a mordant for some colors, chamberlye (urine) was easily procurable, but the use of it was offensive.

Words Out of the Past

Here is an anonymous quotation lent to me by a very old lady: "Butternut bark made a beautiful brown; a certain moss made a tan brown. Alder bark made a seal brown. Birch bark a gunmetal gray. Yellow-root, barberry bark and sassafras made yellows. It always took two things to make green; indigo and goldenrod colored green, also laurel leaves and hickory bark. Black was one of the hardest colors to set; mercury or poison ivy made a pretty good black. Purple flag and elderberries gave lavender, but a fast lavender and purple was hard to get. To set the color in cloth, copperas, alum, salt and sometimes rusty nails were used. Every family had a dye-pot, most commonly used for indigo. After the spinning of the yarn or thread was finished, the housewife was busy getting the dye prepared. All the family knew that chamber lye should be saved for this. The indigo and yarn were put into the earthen pot full of chamber-lye and allowed to stand for a long time, after which it did not need to be 'set.' The odor was very offensive, and sometimes sweet-fern, flag-root or hardwood ashes were used to offset the odor."

Fine Colors Gradually Achieved

Eventually our ancestors came to be proud of the beautiful soft colors they wove into rugs, coverlets and other woolens. The plants for creating these colors were gathered in the woods and fields.

In a book entitled "Suite du Teinturier Parfait" (Paris, 1716) or "Instructions in the Art of Dyeing," there are about 35 recipes for reds to use on different fabrics: silk, wool, linen and cotton. About the only successful red dyestuff for linen and cotton was brazil, the coloring matter which came from brazilwood (*Caesalpinia echinata* and related species) of South America. The wood that became known for the red color it gave had already given its name to the country where it was found, not the other way around. This fact indicates the importance of dyes in early commerce.

Antiquarians and lovers of beautiful things of the past have long known that Venice was the source of the most beautiful fabrics. Perhaps red materials were the most noted; Venetian scarlet was famous all over the medieval world. It is interesting to read that many of the ingredients used for dyes are much the same as our own, but the process remained a secret, as did the Venetian method for black. These were two colors greatly desired by our American dyers. The Venetians also had purple from those famous Murex shellfish of the Mediterranean, another fast color still being sought in America almost until the aniline dyes were introduced.

How long was it to take our American amateurs to perfect their black, red and purple from nature's wild sources alone? The list of browns grew: olive, snuff, bat-wing, dove or lead, slate, cinnamon, dark copper brown, chocolate, and plain brown—and that is not all. Yellows were abundant, but red, purple, and black were difficult to achieve. For blue there was indigo or woad. Peddlers used to come twice a year on regular routes and housewives estimated how much indigo they would need for their amount of yarn.

Though woad was cultivated, it was always considered as secondary. "There was not much difference, chemically, between woad blue and indigo blue, and the woad which grew readily in northern countries was substituted for the Oriental indigo for domestic purposes. This was partly due to the fact that the ashes of woad, when the stems and waste were burned, were the best source of potash and lye; and as such, woad has been used down to the present day as an adjunct to dyeing with indigo in potash solution. . . . But woad was a disagreeable plant, exhausting the soil so that new tracts must constantly be given up to it, and also fermenting in the dyeing process and becoming extremely odorous." [From *The Herbarist,* of the Herb Society of America, Boston, Massachusetts, 1939.]

Native Sources of Ink

Ink was made from several native plants in colonial days. Among them were the pokeberry, inky-cap mushroom, sumac, and the bark of the red maple.

James Franklin, older brother of Benjamin, who was his apprentice in his Boston printing shop, printed *The New England Courant* in 1721, and also did printing of calico and other fabrics "in good figures, very lovely and durable colors, and without the offensive smell which attends the linen printed here," according to his own advertisement in the paper.

The early history of the dyeing industry in the United States is intimately connected with the small towns, according to Sidney M. Edelstein, in a paper published in the *American Dyestuff Reporter*. Almost none of the early American books on dyeing came from the large cities. The first one, appearing in 1798,

The Dyeing Corn

IN Elwin L. Page's book entitled "George Washington in New Hampshire" (Houghton Mifflin, 1932), the author quotes frequently from Washington's diary. There was very little that escaped the great man's eye. Here is a note in his own words: "And having walked through most parts of the Town (Portsmouth), returned by 12 o'clock, when I was visited by a clergyman by the name of Haven, who presented me with an Ear and part of the stalk of the dyeing Corn, and several pieces of cloth which had been dyed with it, equal to any colours I had ever seen, of various colors. This Corn was blood red, and the rind of the stalk deeply tinged of the same colour." The Portsmouth visit was in November 1789. [Brooklyn Botanic Garden tests failed to confirm corn as a dye material, but red corn husks dye wool dark gray.—Ed.]

was "The Country Dyer's Assistant," by Asa Ellis, about whom little is known except that he was "a good dyer and a clear thinker." The next important book on dyeing, *A Practical Treatise on Dyeing and Callicoe Printing,* was published in Philadelphia in 1815. It was by Thomas Cooper, who was evidently a man of hasty temper, for he had to change his residence from time to time to avoid getting into embarrassing political situations. "There was always someone around upon whose feet he trod," writes Mr. Edelstein.

19th Century Dye Books

Also in 1815, "In Conformity with an Act of the Encouragement of Learning," a book in two parts was published giving "A General Plan of Dyeing, etc., Also Milling and Finishing, Stamping and Bleaching Cloths." The first part is by Evert Duyckinck, and it gives many useful recipes for dyeing, staining, painting, etc. It is put together in a rather confusing manner, however, the author discussing his recipes in a chatty, informal way. He recounts not only his triumphs but also his failures in producing reds, violets and purples. One recipe claims that 20 shades of violet color may be produced by varying the logwood and *braziletto* (brazilwood). "The further management of this dye, I have left to the fancy of the dyer, for the color will be beautiful, almost equal to cochineal and indigo. You may use peachwood in part, if you like, instead of all braziletto, but this I leave to your own choice." (Logwood, or peachwood, is *Haematoxylon campechianum,* a Central American tree related to *Caesalpinia.*)

The second part, by Elijah Bemiss, is more narrative. He loves his colors, such as "deep blue, bordering on the violet, brilliant, lively and shining," and he refers to his vat as "she," and treats "her" lovingly. One is entertained as well as instructed.

Meanwhile, in 1811, an anonymous little pamphlet had appeared, with recipes for "Dying, Hot and Cold," price "six pence, for Domestic Uses, in New England." Here is a typical recipe for yellow on cotton or linen (hot): Take two pounds of the leaves or peelings of onions that are clean and clear from dirt; put them in fair water, boil well, and you will have a good color." There are two recipes for plum color or purple (hot), for silks, and another for purple on cotton or linen (cold). Almost all of the 21 recipes begin with the words "Take your Butternut . . ." (or whatever it be), and end, "Handle till your color pleases." One may take this as a primer in the great library of dyeing.

The first book containing colored samples, by Cornelius Maloney, was published in 1833. By 1850 there was a dignified little volume from Philadelphia by Henry C. Baird, successor to E. L. Carey, with quite a repertory of colors, including innumerable browns and a great many reds, all in the cryptic language of the trade. The very first recipe is "To Make Light Purple for One Color on Jaconets," followed by several others evidently intended to assuage the feminine yearnings for purple. (Jaconet is a thin cotton material.) Somewhere I ran across a recipe for "a wash to bring back or strengthen faded purple."

Colors of Old Yarns Today

In the realm of old crewel yarns, one of the ways of approximating the age of a piece of old needlework is the condition of the purple. It has usually turned into a rather violet-tinted gray, probably starting out as a mixture whose components faded differently. In the past, many an attic's storage trunks contained the remains of home-dyed yarns, still usable and still of lovely colors. Between 1815 and 1825 or so, all sorts of reds in various intensities were being produced from madder, and these have stood up well as soft and lovely tones of rose. Perhaps only time was needed to perfect them. The same is true of colors in the old pieced bedquilts made of cuttings or samples manufactured before the fateful date of 1856 when someone discovered mauve, the first coal-tar color. This event completely changed the dyeing industry. Synthetic products replaced color after color, and finally, indigo. ◆

AN AMERICAN HERB GARDEN IN ENGLAND

Dye plants used by early American colonists are among the herbs being grown in this garden at the American Museum in Bath, England. The garden was a gift to the Museum from the Southampton (Long Island, New York) Garden Club and was dedicated in 1964. Some of the herbs came directly from the authentic 17th–18th century garden at the Halsey Homestead Museum at Southampton.

NOTES ON AZTEC DYE PLANTS

Indians of prehistoric Mexico skilled in use of natural colorings

Emily W. Emmart

FRAGMENTS of paint adhering to ancient ruins in Mexico, despite the weathering effects of centuries of sun and tropical rains, attest the lasting qualities of the paint pigments used by the Indians in pre-Conquest times. The brilliant colors of the surviving codices, the bright colored pottery, the fragments of woven material dyed with native pigments which are to be found in numerous museums, all lend credence to the accounts of the 16th century conquistadors and historians who commented enthusiastically on the extensive knowledge shown by the natives of the New World in the preparation and use of dyes. In a letter to the Emperor, Charles V, Cortez wrote: "They have colors for painting of as good quality as any in Spain, and of as pure shades as may be found anywhere." Bernal Diaz, who accompanied Cortez on his first visit to the arcaded market at Tlaltelolco, refers to the displays of decorated gourds and gaily painted jars of wood, examples of which may still be purchased in the Indian markets of today. Fray Bernardino de Sahagun, one of the twelve Franciscans who came to Mexico in 1524, described the colored pigments as black, yellow, green, tawny, violet, and flesh color. These, he noted, were composed of various colors and extracts of pigments from animal and plant sources. Fray Toribio de Motolinia, also one of the twelve Franciscans, mentions, in his historical account of the Indians of New Spain, several pigments of botanical origin which the natives used in dyeing cotton and woolen cloth.

Early Exports of Dyes

Following the Conquest in 1522, the crude materials of three native pigments became important commodities of export. Mention is made of them in letters, historical records, and ships' manifests. One of these dyes, of animal origin, was derived from the cochineal insect (*Coccus cacti*), which lived on the cactus *Nopalea cochinellifera.* The pigment from the bodies of the insects was part of the tribute paid to Montezuma by the neighboring subservient tribes.

Concurrently with cochineal, the blue dye, indigo, was shipped to Europe in large quantities. This dye, known to the Spaniards as "azul de añil" or simply "añil," was derived from *Indigofera suffruticosa,* which grew extensively in Mexico and South America. In the Valley of Mexico the plant was known as "xiuquilitl" by the Nahuatl-speaking peoples, who used the blue dye not only for dyeing cottons and woolens, but also as a cosmetic. The Mexican dye was very similar to that derived from the Old World species of *Indigofera anil.*

Logwood Still in Use

A third dye which was rapidly introduced into Europe during the 16th century was haematoxylin, a purple coloring derived from logwood. This dye was either reddish purple or blue, depending upon the degree of acidity or alkalinity of the preparation. The tree from which the dye was extracted was known to the Aztecs as "uitzquauitl" or "huitzcuahuitl," meaning "spiny tree." Two species of this tree, *Haematoxylon brasiletto* and *H. campechianum,* are still used commercially for the extraction of the dye. The earliest illustration of a species of this tree is to be found in the Badianus Manuscript (Plate 68), where it is entitled "huitzquauitl." Hernandez was the first to describe its staining properties and to relate the dye to the trees known by their native names, "huitzquauitl" and "quamochitl" in the Valley of Mexico, and as "curaque" in Michoacán, and to associate the wood of these trees with that known as "brazil" by the Spaniards. He states that a decoction of the wood was at first yellow, then became red and purple when boiled with alum. There are today no commercial substitutes for this natural dye. Like cochineal and indigo, it has remained an important article of trade, and today is indispensable in the histological laboratory.

16th Century Documents

To investigate further the sources of the dyes indigenous to Mexico at the time of the Conquest one must turn to documents of the 16th century which were written before the Aztec names were forgotten or the native usage of the plants obscured. To the natives of Mexico most plants appeared to have medicinal value, and the dye properties were mentioned often in the directions for the preparation of medical remedies. With the exception of one chapter on medicinal plants in the Sahagun manuscripts, and the occasional mention of a few dye plants of commercial value in historical accounts, only two documents of the 16th century are of primary importance. The first of these is a small herbal entitled *Libellus de medicinalibus Indorum herbis,* which is better known today as the Badianus Manuscript. Until its publication in 1940, this beautiful little herbal had lain unnoticed in the Vatican Library, under the title *Codex Barberini, Latin 241.* The text, dealing with medical remedies known to the Aztecs, is illustrated with 184 aquarelles of plants and trees. The brilliance of the illustrations, even today, attests the excellent quality of the native dyes of Mexico. The manuscript, written in 1552, within 30 years of the Conquest, was the work of two Aztec Indians, one Juan Badianns, who illustrated and wrote the original text in Aztec, and the second, Martin de la Cruz, who translated the text into Latin. All the plant names are in Aztec, and it is the analysis of these names which occasionally gives the clue to the use of the plants as dye sources. This little herbal is unique not only because it was written by Aztec Indians, but also because it contains the first illustrations of the plants of Mexico and is the earliest medical text of the New World.

The second important text is the great herbal of Francisco Hernandez, titled *Medicarum Novae Hispaniae Thesaurus, seu Plantarum, Animalium, Mineralium Mexicanorum Historia.* Because of the news of the rich medical lore of the Mexicans which had been brought to Spain during the 16th century, Philip II selected his court physician, Dr. Francisco Hernandez, bestowed upon him the title of "Protomedico of the Indies," and in 1570 sent him to Mexico to prepare a natural history of New Spain. Hernandez spent seven years in Mexico, exploring and studying the medicinal plants in the Valley of Mexico, especially those cultivated in the famous gardens of Atzcapotzalco, Texcoco, and Huaxtepec. When he returned to Spain in 1577, parts of his manuscripts were left in Mexico. These were published in 1615 by Fray Francisco Ximenez. However, the major part of Hernandez's Thesaurus was published in 1651 by the Accademia dei Lincei. This great herbal lists some 1200 native plants by their Nahuatl names and describes their usage. The analysis of these native names often reveals facts relating to the habitat of the plant, the color of the flower or fruit, the dye produced, or the medical properties, but for the modern identification of the plants one must turn to the 19th and 20th century botanists.

Colors Used in Badianus Manuscript

Of these two 16th century herbals, only the Badianus Manuscript is illustrated in color. The pigments used are orange, yellow, ochre, green, blue, magenta, scarlet, lavender, and white and black. Several sources of black pigment were known to the Aztecs. One was derived from the pods of the "nacascolotl" (*Caesalpinia coriaria*). Black soot from the "ocotl" or pine was commonly used; it is reported that a black dye was also prepared from the gum of *Prosopis juliflora*, called "mizquitl" in the Badianus Manuscript. In this herbal two different plants are referred to by the Aztec name "tlayapaloni," meaning "abundant-black-paint-plant." One is a climbing grapelike vine with clusters of reddish berries. The other is a bromeliad-type plant with fruiting bodies on a single upright stalk. The cherry "capulxihuitl" (*Prunus capuli*) was probably another source of purplish-black pigment.

Besides the haematoxylin already mentioned, a purple dye was extracted both from the fruit of the mulberry and from *Jatropha curcas,* which was known to the Aztecs as "quauhayohuatli." And mention should be made, although it is not of plant origin, of the excellent purple dye obtained from the sea clam, *Purpura patula*, found on the southwest coast of Mexico.

Sources of Red

Reddish pigments were obtained in a wide range of colors, some of which may have been used as a mixture of several dyes. A red pigment was obtained from the poinsettia, *Euphorbia pulcherrima,* which was known to the Aztecs as "cuetlaxochitl." A pigment was also extracted from the red flowers of the wild dahlia. Safford reported that both red and yellow dyes were obtained from *Cosmos sulphurus.* Similarly, the aril of the seeds of *Bixa orellana* yielded either yellow or red pigment. This was known to the Aztecs as "achiotl" and today as annatto (under several different spellings).

Yellow pigment was obtained from a leafless parasitic plant called by the Aztecs "zacatlaxcalli," identified as *Cassytha filiformis,* and from the bark of *Erythrina americana.* Another species, *Erythrina coralloides,* yielded a colored extract which was used in an eye lotion. This may also have been a source of pigment.

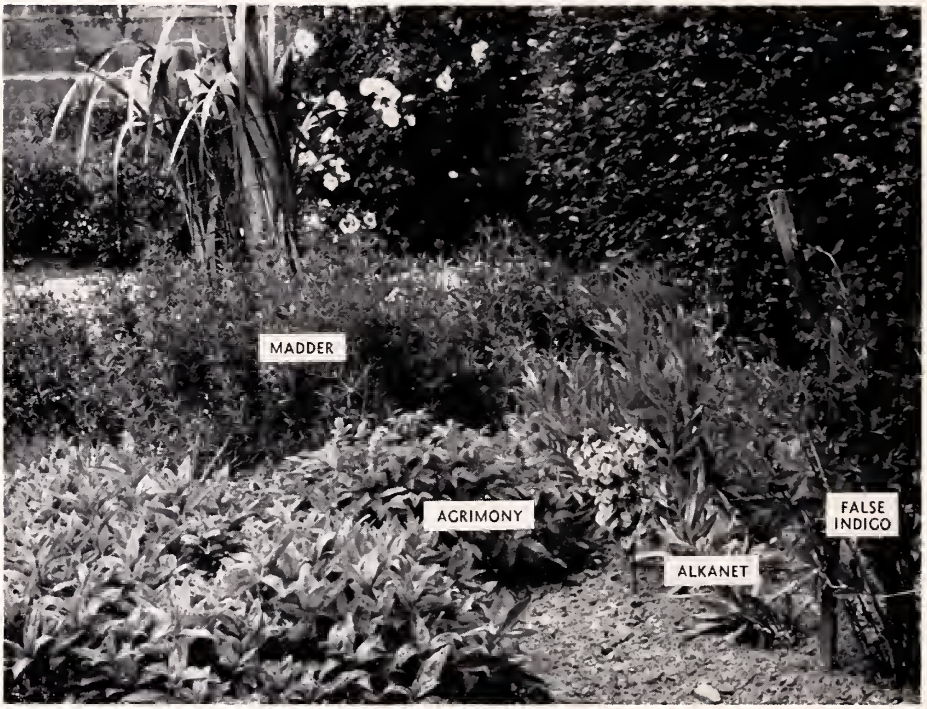
Besides the native indigo, bluish pigments were obtained from several plant sources. One, known as "mohuitl," came from two species of *Jacobinia, J. mohuitli* and *J. umbrosa,* and still another from the fruit of *Cissus sicyoides.* Various shades of brown were obtained from earth pigments as well as from the oak, and probably other unidentified sources. Green was most likely obtained by a mixture of indigo and yellow pigment.

To achieve light colors, white earth, "thicathalli," was mixed with the extracted pigment. Alum, "thalxocotl," was added to increase intensity and bind the color. The black fetid earth containing iron and sulphur deposits, which was collected as a scum near the shores of a salt lake and on the edge of hot springs, was used as a binding agent in preparing paints. Hernandez reported that in mixing pigments the Aztecs used an oil or wax called "axi" or "aje." This was obtained from the insect *Coccus axin,* which was bred for the purpose. The insects were boiled and the wax skimmed off the surface of the fluid and used both as a varnish and a pigment base. A crude turpentine was also prepared and used as a thinning agent. These few details tell us but little of the general practices of the Aztecs in securing the remarkably lasting qualities of their dyes.

Discoveries of the Future

Indeed our knowledge today of the dyes and dye plants of Mexico must represent but a fraction of that possessed by the Indians of four centuries ago. Moreover, the probability that many of the plants familiar to the Aztecs still exist in modern Mexico is a major challenge to the plant explorer. Analysis of the Aztec plant names in the great Thesaurus of Hernandez, and in the Badianus Manuscript, suggests that many of the plants treated in these herbals may have been the source of dyes unknown to us. Botanical identity has been established for only a few; the rest must await the future efforts of the ethnobotanist. ✦

DYE PLANTS GROWING IN A SCOTTISH GARDEN



Robertson

A corner of the private garden of William Robertson in Dundee, Scotland, where he aims to grow every textile and dye plant that will survive in this coastal region.

William Robertson

A NUMBER of years ago when I asked a prominent jute manufacturer if he could give me a photograph of *Corchorus capsularis,* he was unable to help. I remarked, probably acidly, that it seemed odd that three generations had prospered in the same mill and yet they did not have a photograph of the plant upon which their livelihood depended. His answer was put in the form of a question. "You're a linen man—do *you* have a picture of *flax?*" To my embarrassment I didn't. There and then I decided to create a collection of textile plants—those used for dyes as well as fibers—and take my own pictures.

At first sight the cold east coast of Scotland does not seem to offer much hope of success. Dundee is roughly in the same degree of latitude as the south tip of Kodiak Island in the Aleutians. Summers are cool, frequently overcast, with temperatures seldom above the 60's. Winters are not severe by continental standards, but there are long periods when the thermometer hovers at, or just below, freezing point. With insufficient snow cover this makes it difficult for some plants to survive. However, even if the sun appears erratically in the summer, it can still account for a respectable daily average due to the fact that in June and July it seldom gets really dark. Under these conditions Edinburgh, a mere 60 miles further south, still contrives to have one of the world's best botanic gardens.

My house is named "Tighnabruaich," which means "house on a bank." Facing north to the hills, it is well placed to see occasional displays of the northern lights. As witches, warlocks, and fairies are particularly prevalent in Scotland, in accordance with old Scottish practice, the house is carefully guarded by rowan trees (*Sorbus aucuparia*), which are supposed to afford complete protection. The local soil is extremely fertile and, given spring protection from wind and ground frost, plants grow with surprising speed. In my garden, soil conditions had, of course, to be specially provided for peat-loving plants, and one or two pockets were specially made from shingle, grit, and poor mountain soil, laboriously collected on safaris! Moisture-loving plants such as bog-myrtle or sweet gale (*Myrica gale*), have to be given their full ration of water, as there are no extremely wet areas in the garden. Contrary to popular imagination abroad, rainfall in east Scotland is no more than just enough for normal farming.

The areas I have devoted to textile plants are not particularly impressive. They have to compete with vegetables, fruit, roses, and "flowers for the vases." Mrs. Robertson is very firm about this, pointing out that the "botanics" are nearly always weedy and uninteresting, and in any case, she is not allowed to cut them! Also it should be noted that annuals (such as hemp and flax) and biennials disappear as soon as they have served their purpose, making room for something else. Lastly, dye plants such as strawberry-blite (*Chenopodium capitatum*) are noxious weeds, so they are grown under very careful control. Such plants, with their boxes and soil, are ruthlessly destroyed as soon as photographs of the flowers have been obtained.

The Scots have a long tradition in vegetable dyeing. Local dye-producing plants are, in fact, so abundant, that there is little point in growing them specially. Lichens, also abundant, supplement dyes from flowering plants and the varying brown shades of natural sheep wool. Plants permanently grown in my garden, therefore, tend to be difficult-to-

Robertson

Madder (*Rubia tinctorum*), the red dye plant of antiquity, thrives and blooms in the Robertson garden.

Cultural Requirements of Dye Plants

In my experience in East Scotland, the following plants are not fussy about soil as long as it is good farm loam: madder, blackberry, safflower, weld, woad, nettle, soapwort, agrimony, anchusa, anthemis, asperula, baptisia, berberis, cornus, ligustrum, euonymus, polygonum, serratula.

Wet soil is needed for meadow-sweet. Woad demands precautions against cabbage troubles such as club-root and cabbage root fly. Euonymus is particularly a menace with black fly aphis and is poisonous. Weld seeds rather freely but is easily dealt with by hoe. Soapwort is the most aggressive plant I have (apart from meadow-sweet).

Peat is best under the given conditions for these plants:

Semi-shade—bloodroot
Full sun—heath, heather, kalmia, mahonia
Very wet—bog-asphodel, bog-myrtle

In gravel or stony ground I have lily-of-the-valley (gravel in semi-shade); gorse (stony soil in full sun); bedstraw and goldenrod (in river shingle). In sand on dry banks in full sun, genista, bedstraw, smoke-bush and St.-John's-wort are growing. In pure sand I have saffron. I have tried growing it indoors in bulb fiber, but it will not flower.

get specimens, though here and there local plants appear if they have interesting characteristics.

Dye plants form the largest group in my garden. Here are brief notes concerning the more important or interesting ones. Items starred (*) give reliable dyes. Names with a dagger (†) are of plants that were formerly of commercial importance.

Bloodroot (*Sanguinaria canadensis*)—red

American Indians used the juice of this plant both for a dye and as a war-paint. Peruvian Indians believed that it cured arthritis. A slave charm in colonial times, it was said to avert evil spells. Slow to establish itself in my garden, it is now thriving.

Bog-asphodel (*Narthecium ossifragum*)—yellow

The shimmering blossoms of true asphodel suggested ghosts to the Greeks. This Scottish plant is a little gem, studding the wet moors with its yellow flowers. Used in the Shetland Islands as a substitute for saffron, and in Lancashire as a hair dye.

Bog-myrtle (*Myrica gale*)—yellow

A versatile plant, formerly indispensable to the Highlander. The leaves provided tea and medicine; their wax made aromatic candles. Long before hops, the plant was used to flavor beer. It was further used not only as a yellow dye but also as a flea repellent in bed! Modern Scouts are still taught to bruise the fragrant leaves in their tents to discourage insects.

*†**Dyers' Greenwood** (*Genista tinctoria*)—yellow; green when dyed over blue

Worth a place in any rock garden. Formerly used as a greening weed to convert blue into Kendal green. The historical term "Plantagenet" is said to have been derived from the custom of Geoffrey, Count of Anjou, to wear a sprig of broom "planta genista"—in his cap.

***Ladies' Bedstraw** (*Galium verum*)—coral color

Also called "Our Lady's bedstraw" because, according to a medieval legend, the plant was used during the Nativity. As a reward, its white blossoms were changed to gold. Also used as a styptic agent, and (with nettle leaves) to curdle milk during cheese making. One would expect a relative of madder to provide good dyes, and coral shades obtained from the root are superb.

Meadow-sweet (*Filipendula ulmaria*)—black (from roots)

This plant has taken over a damp north

bank in the garden, where its fragrance is perhaps a little sickening. Once used to flavor mead and to cure malaria. The roots provide a black dye, which, however, does not compare with the beautiful black provided by the bark of common alder (*Alnus glutinosa*).

*†**Madder** (*Rubia tinctorum*)—red

"Plays its part in half the hues of oriental rugs" (Mumford). The rather dull brick red from the roots has been used by physicians in studying bone growth. Middle-east dyers, by strange mixtures of rancid olive oil, cow-dung, ox-blood, potash, alum and galls, knew how to convert madder into fiery Turkey red. There is no space here to describe the cloak-and-dagger exploits of European spies wresting secrets from their Oriental rivals.

*†**Venetian Sumac**—*Cotinus coggygria* (*Rhus cotinus*)—yellow

During late summer the spectacular inflorescence changes from salmon-pink to smoke-gray, thus accounting for names such as "burning-bush," "smoke-plant," and "wig plant." The yellow dye is obtained from the twigs or bark. The related *Rhus coriaria*, the dyers' sumac, has been described as the greatest gift of the Arabs to Sicily.

Blackberry (*Rubus fruticosus*)—orange (from roots)

It is said in Scotland that Christ used this prickly plant to scourge money-lenders in the Temple, hence the Gaelic name "an druise beannaichte" the blessed bramble. In my garden the fruits are more highly valued than the orange dye contained in the roots.

*†**Safflower** (*Carthamus tinctorius*)—yellow or red

Known to the Egyptians, and used in Indonesia long before turmeric became popular. First of all, the worthless yellow dye contained in the petals must be removed by washing. The red dye that results is valued but is difficult to apply.

*†**Saffron** (*Crocus sativus*)—yellow

Used in the religious festivals of

Robertson

Dyer's greenweed (*Genista tinctoria*), a small shrubby plant, gives a yellow dye which has frequently been used to convert blue into green.

Robertson

The yellow-flowered ladies' bedstraw (*Gallium verum*), also called "Our Lady's bedstraw," grows on roadsides in Britain and on the continent, and is also sometimes seen in the United States; it has thickened roots from which a fine coral-color can be derived.

Minoan Crete, as a valued spice in Imperial Rome, and as an international commodity which gave its name to the Basle Saffron Guild because of its value as a yellow dye. In my opinion, the most beautiful of all crocus blossoms, but a shy bloomer in Scotland, where it thrives best in pure river sand under cloches.

*†**Weld** (*Reseda luteola*)—yellow or yellow-green

The leaves, flowers, and stalk all provide a pure lemon yellow. A striking weed with attractively crimped leaves, it grows well in Scotland and seeds freely. It has appeared in Swiss neolithic settlements. With a ferrous sulphate mordant the dye produces handsome greengage-olive shades.

*†**Woad** (*Isatis tinctoria*)—blue

The long bitter struggle between woad growers and importers of tropical indigo is a fascinating story. Indigo (from both plants) is the only really good vegetable blue. Logwood does provide a useful blue but the tree is more valued for its lustrous black. Blues from berries such as the bilberry (*Vaccinium myrtillus*) are purplish and useless for commerce. In Scotland, the woad plant grows vigorously and flowers freely but its uninteresting cruciferous flowers would not enhance the appearance of the flower border.

Among other dye plants in my garden are agrimony (*Agrimonia eupatoria*), alkanet (*Alkanna* or *Anchusa tinctoria*), chamomile (*Anthemis tinctoria*), woodruff (*Asperula tinctoria*), false indigo (*Baptisia tinctoria*), barberry (*Berberis*

Robertson

Alkanet (*Alkanna* or *Anchusa tinctoria*), an old-time dye plant with purplish flowers. Its root makes a reddish-brown dye.

vulgaris), dogwood (*Cornus stolonifera*), spindle-tree (*Euonymus europaeus*), St.-John's-wort (*Hypericum perforatum*), mountain-laurel (*Kalmia latifolia*), privet (*Ligustrum vulgare*), Oregon-grape (*Mahonia aquifolia*), knotweed (*Polygonum persicaria*), and serratula (*S. tinctoria*).

The above list comes far from exhausting the contents of my garden. Dye-producing plants such as lily-of-the-valley, walnuts (green husks), broom, gorse, heathers, heath, black currants, and many others can be used. Also without really trying, most gardeners can produce dandelion (magenta from roots) and dock (black from roots). If some readers are puzzled by different colors attributed to plants, it must be realized that the colors obtained depend on the mordant used and the dyeing techniques.

The kermes oak (*Quercus coccifera*) is of interest to dyers because it is the host plant of the kermes insect which formerly provided the world's best scarlet dye. The memory of kermes is preserved in European languages in Karmin (German word for carmine), cramoisi (French) and in our own word "crimson." Only half-hardy in Scotland, the tree needs protection, and in this rigorous climate the kermes insect does not infest it.

The Egyptians and Jews used the leaves of soapwort (*Saponaria officinalis*) to provide a preparatory process before dyeing. The lather produced is thin, however, and not very satisfactory. The plant itself, although quite beautiful, has a root system which is too aggressive for the average garden.

The collection described above has obvious limitations, but it is only fair to state that it is often difficult for an ordinary citizen to acquire unusual specimens. One need not elaborate the problems of surmounting customs formalities and getting replies to correspondence! However, I have had the good fortune to visit many parts of the world, and as a relief from the tensions of business, have visited most of the famous gardens in the U.S.A., Mexico, the Caribbean, Europe (including Sicily) and of course, well-known British ones. I am pleased to report that on the whole, American authorities have been very helpful indeed, and that it was possible to track down and photograph many missing specimens in the collections there. It gives me particular pleasure to state that the tropical houses provided by The New York Botanical Garden in The Bronx and the Brooklyn Botanic Garden have been of great assistance.

Robertson

Weld (*Reseda luteola*), also called dyer's mignonette, gives a fine, long-lasting yellow; with ferrous sulfate mordant, unusual green tones are obtainable.

PLYMOUTH COLONY'S DYE PLANTS

Garden at Harlow Old Fort House shows what early settlers used for coloring textiles

Rose T. Briggs

DURING the first years of Plymouth Colony, the Pilgrim settlers used what clothes and textiles they brought with them, having neither time nor materials to make new cloth. When the ship *Anne* came in to Plymouth in 1623, Governor Bradford ruefully records that the patched and mended clothes of his pioneer colonists had endured as much as their bodies. But what of it? To quote one contemporary jingle: "Double patches are warmer than single whole clothing!"

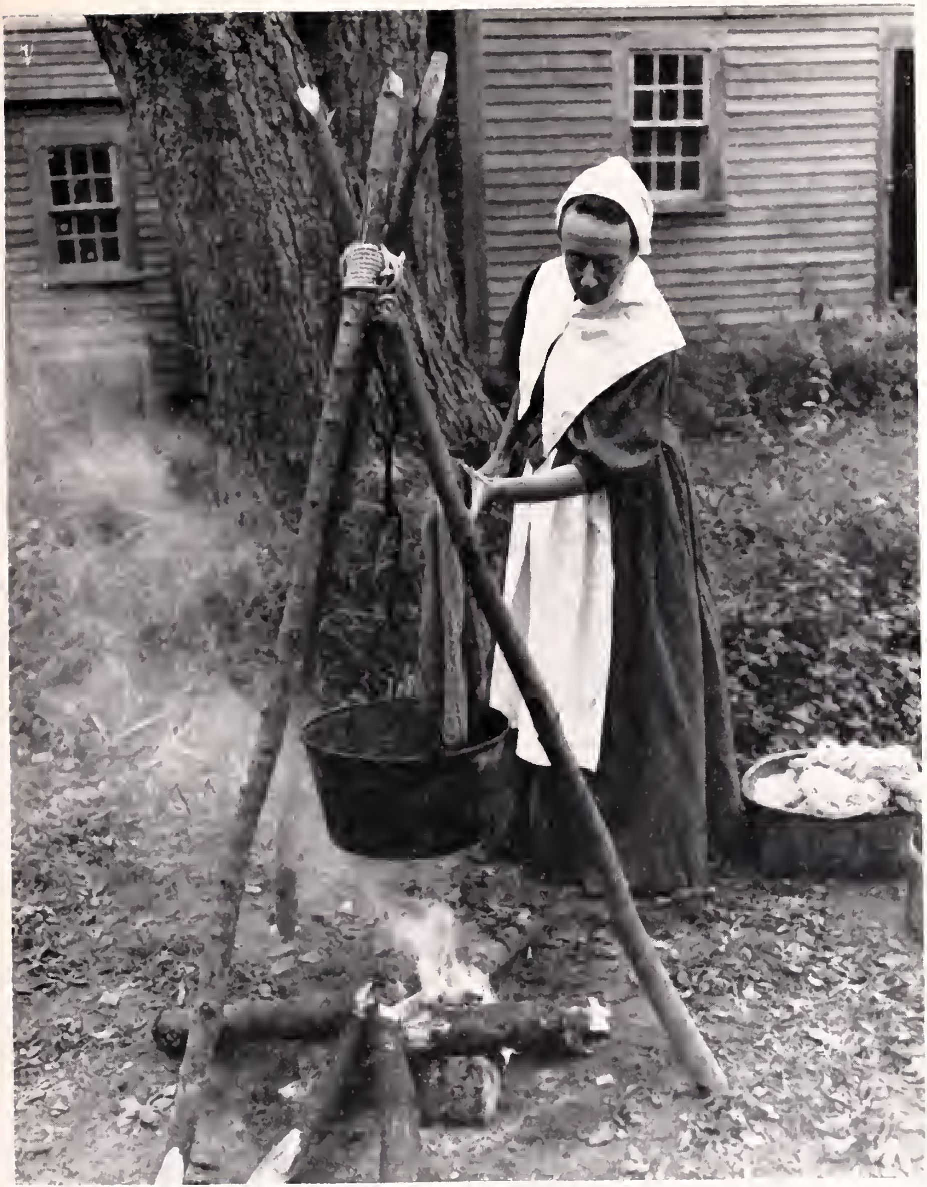
Though Plymouth's Patent of 1621, now in Pilgrim Hall, Museum of Pilgrim Treasures, lists the raising of flax and hemp as one of the industries proposed for the new colony, spinning wheels and other household textile implements do not begin to appear in the inventories until the 1640's. One can assume that the household implements that appear in a man's inventory have been in use for some time. Certainly in 1639, every household was required to plant at least one square rod of flax or hemp for its own use, and sheep were not to be sold out of the colony. Obviously, cloth was being made; but there is nothing to indicate that it was done on a professional basis. It would appear that each housewife supplied the ordinary needs of her household. Finer materials were imported. After the arrival of Winthrop's colony in 1630, ships came to Boston every year, bringing goods for which Plymouth settlers could exchange the cattle and farm produce the new colonists needed. Bradford's inventory (1657) lists cloth in wholesale quantities. Bradford was one of the "undertakers" who assumed responsibility for Plymouth Colony's debt to the London merchants who had furnished money for the original expenses. This cloth was no doubt to be sold or traded to raise money to pay off the debt.

What resources had the Plymouth housewife for dyeing her homespun yarn and cloth? Madder for red and indigo for blue had to be imported; the "West India" trade, which brought such items as "cotton wool" into 17th century inventories, must have made some Caribbean dye-stuffs available, if one had money to buy them. How about native dye-stuffs?

At the Harlow Old Fort House in Plymouth, the Plymouth Antiquarian Society has experimented with the dyeing possibilities of native material. This work is part of its program for exploring and demonstrating the way the Plymouth Colony housewife met the needs of her family. At Plimoth Plantation (a restoration of the Plymouth settlement as it probably appeared about 1627), there is also experimenting with native dyestuffs.

The problem in dyeing is to impregnate the fiber to be dyed with the coloring matter, and so fix it that it will remain when the superfluous dye is rinsed out. This means that there must be real chemical and physical affinity between the fiber and the dye-stuff; and this depends upon the chemical and physical qualities of both. Wool, silk, cotton, and linen all react differently to dye-stuffs. Some dyes suitable for wool will not dye cotton at all. Since the preparation of wool is a speciality of the Harlow Old Fort House, our experiments have been carried out with wool.

Most vegetable dyes require a mordant of some sort, to fuse with the dye-stuff and fix the color upon the fiber to be dyed. Many early mordants were household staples such as salt, vinegar, soda, cream of tartar, or lye. Both "drip lye" made at home from wood ashes (and also used for making soap and bleaching) and "chamber lye" (urine) were used. Alum, although it had to be bought, was per-



Dyeing homespun yarn in 17th century colonial fashion, as demonstrated at Harlow Old Fort House, Plymouth, Massachusetts.

haps the most useful mordant of all, especially for bright colors. Copperas (ferrous sulfate), which was invaluable for dark colors, also had to be purchased. When used as a final bath after the dyestuff had been applied, the process was called "saddening," and the result a "sad color." Blue vitriol (copper sulfate) was also used as a mordant. I do not know how early chrome (potassium dichromate) came into use as a mordant, but it gives excellent colors, more orange in tone than those obtained with alum. Some common metals, such as iron, brass and tin, act as mordants, and results can be obtained by using a vessel of the proper material. Thus a brass kettle was preferred for bright colors, an iron kettle for dark ones. Sumac and oak were useful as mordants as well as for coloring.

Chips, bark, roots, the hulls of nuts, leaves and flowers were all used as dyes. Some had to be used fresh. Some differed in the color developed according to the season in which they were gathered. Berry juices, although they appeared promising, produced stains rather than dyes, and faded or changed color quickly on cloth. The Harlow Old Fort House has found no lasting red nor satisfactory blue among the native materials it has tried. Even pokeberry (*Phytolacca americana*), with its magenta juice, fades to an unremarkable brown when applied to woolen yarn, though it can be used as a reddish stain for basket materials. Nor have the red fruit-heads of staghorn sumac (*Rhus typhina*) proved more satisfactory. The only color they develop which can be fixed on wool is a tan, which the addition of chrome turns to a yellow brown, and copperas turns to gray or black. The native dye-stuffs produce a wide range of yellows and browns, some grays and approximate blacks, and some greenish grays or grayish greens; but madder for red and indigo or logwood for blue had to be imported. Green was usually made by top-dyeing yarn already dyed with indigo, using yellow from some native dye-stuff.

Here are the plants now being grown at Harlow Old Fort House, as representatives of those used by some of the early settlers for dyeing. Except for *Genista*, which now grows there as an escape, and the household onion, all could be found in the wild.

Alder (*Alnus vulgaris*). The bark, with alum, dyes brownish yellow; with copperas, gray brown. The leaves, with alum, dye greenish yellow.

Apple (*Malus sylvestris*). The bark with alum gives yellow tan. Cultivated apple can also be used.

Bayberry (*Myrica pensylvanica*). The leaves can be used green or dry; with alum mordant they give yellow; with copperas (ferrous sulfate) added, olive gray.

Beach Plum (*Prunus maritima*). The leaves, with alum, give yellow.

Black oak (*Quercus velutina*). The bark dyes yellow; with copperas added, olive green.

Black Walnut (*Juglans nigra*). Both the hulls and bark of the walnut provide one of the standard brown dyes. It can be used with or without additional mordants. Edward Winslow mentions the tree as found in Plymouth.

Bracken (*Pteridium aquilinum*). Used with alum and copperas, gives olive.

Dyer's greenweed or **wood-waxen** (*Genista tinctoria*). This was introduced at Salem very early for dyeing yellow.

Goldenrod (*Solidago*). All species tried give a good yellow with alum. They are at their best used fresh.

Hemlock (*Tsuga canadensis*). The mature bark, with alum or alone, gives a warm brown.

Lichen. Lichens are often mentioned as a valuable source of dye. We have had good success with a gray, lacy lichen, growing in circles on oak and pine trees, which I have been unable to identify by name. It is associated with a similar lichen, with slightly larger and greener fronds, which is less satisfactory. The color produced varies from tan to orange brown. No mordant is needed.

Onion (*Allium cepa*). Skin used with alum mordant. Yellow is obtained by steeping, brown by boiling.

Red Maple (*Acer rubrum*). The bark, used with alum, gives olive; with copperas, gray.

St.-John's-wort (*Hypericum perforatum*). Alum mordant. If picked in July, this gives gray; in August, greenish yellow.

Sassafras (*Sassafras albidum*). The flower gives yellow with alum; the root, used with plum bark, brown.

Sheep-laurel (*Kalmia angustifolia*). With alum and copperas, dyes olive green.

Sumac (*Rhus typhina* or *R. glabra*). Both give tan with alum, gray to black with copperas.

Tupelo (*Nyssa sylvatica*). Gives yellow tan with alum.

White Oak (*Quercus alba*). With chestnut bark produces dove color; colors basket splints blue gray.

Willow (*Salix nigra*). Gives rose tan with alum. ◆

HOW ONE DYER STARTED

Needs of mountain children stimulated teacher to learn new craft

HELEN VINER of Tryon, North Carolina, went into the Kentucky mountains after her graduation from Vassar College to teach at a settlement school for boys and girls, just being started in Harlan County. But she did much more than teach the mountain children, and eventually, out of part of her experience there, she and her husband wrote "The Katherine Pettit Book of Vegetable Dyes." Here is the story of how she became involved in dyeing, as revealed in her autobiographical manuscript, "Pleasant Memories of Pine Mountain."

Helen Wilmer Stone Viner

SOME of my children at the settlement school in Kentucky came from broken homes, some were orphans and all were poor. I could get dresses for the girls and suits for the boys from the wonderful missionary boxes the school received, but warm sweaters, stockings, mittens and caps were hard to find. I was in despair to get my children warmly clothed.

I was telling my troubles to an old friend from down the creek, Aunt Leah Smith, and she advised me to swap old clothes for raw wool. Many neighbors had a few sheep. Once a week I "kept store" for the school and sold to the people the clothes that were not suitable for use at the school. So I followed her advice and swapped for the raw wool. Aunt Leah showed me how to wash and pick the wool. After that I swapped old clothes to have the wool spun into a single strand of yarn thread. It was brought back to me in corn shuck "broaches."

We had a spinning wheel at the house, and I doubled and twisted the two single strands together and had some very fine handspun knitting yarn. It was after World War I and every one had been in the habit of knitting, so I sent the yarn off, and my friends in various places knitted it up into sweaters, stockings, caps and mittens.

Still my problem was not solved, for all these garments were made of white wool, and with active children playing out-of-doors, making mud pies, bringing in coal, it was impossible to keep their things looking clean.

Dyes From the Woods

So again Aunt Leah came to my rescue, and told me I could get all the pretty colors I wanted out in the woods. Thus began my first interest in vegetable dyes. We went out in the woods and gathered walnut hulls, sumac berries, hickory bark, black oak bark, sedge grass, hard maple bark, the horse-sugar leaves, the dye-flower and many others. I sent off and bought madder root and indigo. I learned to dye with all of them. So the children wore sweaters made of handspun, vegetable-dyed yarn of every color of the rainbow, beautiful indigo blue, madder reds and rose, dye-flower orange, all shades of yellows, browns, grays, lavender and purple. It was just plain necessity that brought about my great interest in vegetable dyes.

Afterwards it was most interesting to find that the old recipes for dyes, handed down by word of mouth in the remote mountain communities, corresponded almost identically with those written down in books two hundred years before. ◆

How a group of handweavers set up

A WORKSHOP IN DYEING

WHEN a group of handweavers in Niles, Michigan, undertook a project in dyeing their yarn with natural products, many weeks of individual study and open discussion in meetings preceded the five-day workshop at which yarns for future display and reference were dyed. Mordants and yarn and other needs were purchased in advance. Eighty recipes were written out on 5 × 7-inch cards, each one numbered. When not in use these were kept in envelopes by color—yellow-gold-brass, brown-black-gray, indigo, and so forth. Recipes in use were clipped to a line or taped to the wall near each dyepot.

Early September was selected for the workshop, because many dye plants available locally would be in good condition at that time. All the required equipment was set up in a garage with individual electric burners for each dye pot. (Although recipes are normally proportioned for one pound of wool, a specified proportion was used for each dye batch in this project.)

The procedure, drawn from *Handweaver and Craftsman* magazine, Winter, 1963, is described here by one of the two co-chairmen of the project.

Kay Boydston

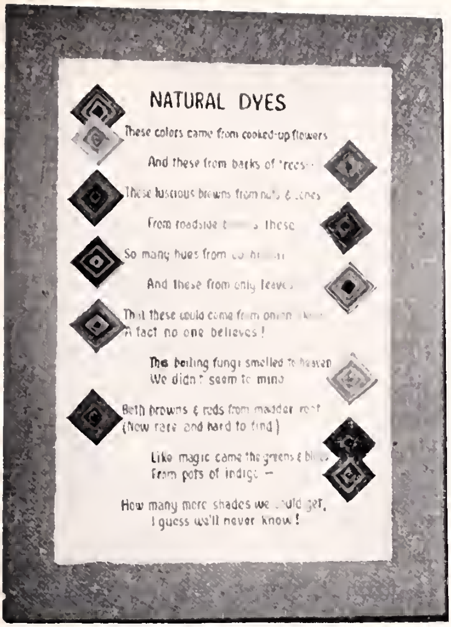
ON a central table in the garage where our project was set up were boxes of yarn containing small and large skeins for sample and display, each tied firmly but loosely in several places with strong but soft cotton twine. (Unless this is done, the yarn becomes a hopeless tangle.) The chemicals and scale and thermometer were here, also a pile of dress hangers, dozens of clip clothespins and many cardboard tags with string attached. Our list of 80 recipes, by number, was tacked to the wall, and the envelopes containing all the recipes were at hand for ready use. Each weaver had a similar envelope for her own notes.

On the first day several pounds of yarn in small skeins were mordanted in alum and in chrome. Dye plants for the next day's use were assigned.

The next morning we came with curiosity and some uncertainty. We came, too, with armloads of goldenrod and Queen Anne's lace, with baskets of marigold flower heads, with bags of bark and with pails of nuts and berries.

The group had been divided into teams of two or three. Each team had chosen recipes which called for dye material of special interest or easy availability, and that team was responsible for that dye from the time of collecting through the soaking, dyeing, rinsing and until the yarn was out of the ooze and hung up to dry. Sometimes a team could keep two or three recipes in progress. Each team attended to its own, but of course there was much peeking into other likely or unlikely-looking pots of color and a general gathering-round whenever it was time to lift out the wool.

Some yarns were rinsed right away. Some were dried before rinsing. Some dyes, marigolds for instance, were quick and easy. Some, as walnuts and bark, stretched over 24 hours or more. When drying time came, the small sample skeins were clipped to hangers, the larger skeins looped over them, and *each one as it came from the dye bath* was marked with a temporary tag, giving just the number of the recipe. The first ones to go on our line had many shades of yellow from marigolds—some clear and clean, some



NATURAL DYES

These colors came from cooked-up flowers
And these from barks of trees —
These luscious browns from nuts & cones
From roadside [illegible] these
So many hues from [illegible]
And these from only leaves
That these could come from onion [illegible]
A fact no one believes!
The boiling fungi smelled to heaven
We didn't seem to mind
Both browns & reds from [illegible]
(Now rare and hard to find)
Like magic came the greens & [illegible]
From pots of indigo —
How many more shades we could get,
I guess we'll never know!

This wall hanging was made to demonstrate the dyer's craft in a group project staged by the Handweavers' Guild of Niles, Michigan. The colors shown are, *left, top to bottom:* yellow tones from marigolds; pastel tints from various wild flowers; tans and browns from nuts and cones; pink, rose, red and purple from cochineal; orange, rust and yellow tones from onion skins; coral, reddish brown and brownish reds from madder. *Right, top to bottom:* grays, tans and browns from various barks; grays from sumac berries, lavender from elderberries, red from pokeberries; caramel-color, golds and tans from various leaves; soft tones of beige from fungi; many blues and greens from indigo.

soft and "sad." As the days passed, hangers of other colors were added—the reds of pokeberry and madder, lovely browns from walnuts, grays from sumac, pinks, purples and reds from cochineal and finally, on the last day, the many blues and greens from indigo. Our rainbow was complete.

At the end of our exciting week, all yarns were packed away with their temporary tags until after the busy holiday season. They seemed even more beautiful when in January they were brought out again, the cotton ties cut off and a better permanent tag attached to each skein—this time a round metal-edged tag with the dye plant used written on one side and our recipe number, time required and mordanting information on the other. At this time a check was made to see that there was a small sample skein for every color and every dye. If not, one was taken from the large skeins. At the same time, a little more of each was wound off, marked as to dye plant, and put into bags labeled "barks," "leaves," "onions," "berries," etc. There were twelve categories. Several sets of cards wound with yarns were also made, all the colors from one dye material on one card, for easy reference. The small skeins, 129 of them, will never be used, but kept as reference material for the group. The large skeins have been arranged on a spool rack and exhibited in a shop, where they never fail to elicit interest. The yarns have also been shown at conferences of handweavers.

We were quite amazed that we could get around the color wheel with our natural dyes; all primary and secondary colors are true, and the shades between are good.

Bits from the larger skeins are used by our members for any technique or design requiring only small amounts of color. These, of course, belong to the individual weavers, but are to be made available for later displays if needed.

To show the blending of any or all of our colors, we have also made two mounted wall hangings of cream-colored burlap, one from the category bags; the other, just various color blendings of particular appeal. But our color wheel is our best effort to date.

With this project we had a taste to whet our appetites and we hope some day to pursue it further with plants not yet recorded or with the plants we used gathered at different times of the year, or used with different mordants. The whole field of over-dyeing beckons—the art of dyeing first in one color, then in a second. Our various yellows put with indigo to give many shades of green show the infinite possibilities here. ✦

HISTORIC WORKS ON DYEING

Sidney M. Edelstein

THE main sources of information on the history of dyeing are books: new books, old books, all kinds of books. Often, however, we need more intimate material: manuscripts; for dyeing was carried on in a comparatively advanced manner thousands of years before the invention of printing. While most of the very old methods have been discussed in printed books, manuscripts give us our only exact source of knowledge of early practices.

Finally, we need collateral material to get the "feel" of the times and of the people. Besides books and manuscripts we therefore need pictures and medals and letters and pamphlets and broadsides and advertisements and sample books—anything and everything connected with dyeing.

So far as we know, there is no complete bibliography devoted to this subject. The nearest thing is "A Bibliography of Dyeing and Textile Printing" by L. G. Lawrie, published by Chapman and Hall, London, 1949. Since many of the books on dyeing as well as on bleaching are actually books on technical chemistry, bibliographies of chemistry can often give us the detailed information we seek. Perhaps of first importance among these is "A Select Bibliography of Chemistry" by Henry Carrington Bolton, published by the Smithsonian Institution, Washington, D. C., 1893, with supplements in 1899 and 1904. Two other excellent chemical bibliographies are John Ferguson's "Bibliotheca Chemica," Glasgow, 1906, and Denis Duveen's "Biblioteca Alchemica," London, 1949.

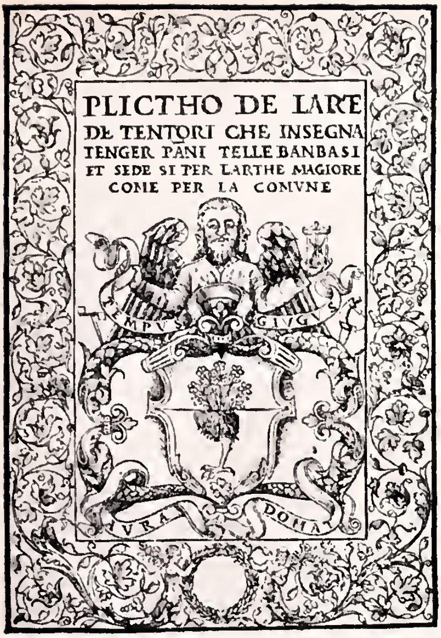
While the original works themselves should furnish our main knowledge of the history of dyeing, no one can read every original work and we must therefore resort to secondary sources which serve as histories. As far as I have been able to discover, there is no completely satisfactory book on the history of dyeing; but there are many fine books on the history of chemistry, technology, and on certain phases of dyeing and also bleaching.

"The Earliest Chemical Industry" by Charles Singer, London, 1948, relates the history of alum. Since alum's main use through the ages was as a mordant in dyeing, Singer had to concentrate a great deal of his historical research on dyestuffs and dyeing. His information on dyeing in the Middle Ages is particularly valuable.

"A History of Technology" edited by A. J. Holmyard and A. R. Hall, in five volumes, Oxford, 1954-1959, presents data on bleaching, dyeing, tanning, spinning, weaving and their interrelationships. J. R. Partington's "Origins and Development of Applied Chemistry," London, 1935, contains useful information on ancient dyes and chemicals. The "Chemical Revolution" by Archibald and Nan Clow, London, 1952, has many chapters covering dyeing, calico printing, and the manufacture of dyestuffs and mordants in Great Britain. "The American Chemical Industry" by William Haynes, in six volumes, New York, 1945-1954, is unquestionably the best source of information on American dyestuff companies, on the history of the development of the dyestuff industry in the United States, and on dyeing and related technology from the American colonial period down to the present date.

Finally we should not neglect the books on dyeing procedures, for they usually have a chapter devoted to the history of the subject. This is particularly true with some of the older books, such as Berthollet's "Dyeing" and Bancroft's "Permanent Colours."

The number of books on dyeing published from 1500 to 1856 (the year of Perkin's discovery of synthetic mauve) adds up to about 260 in Lawrie's bibliography, mentioned above. Since Lawrie missed many items, the total number was probably twice this amount. Most were



PLICTHO DE LARE
DE TENTORI CHE INSEGNA
TENGER PANI TELLE BANBASI
ET SEDE SI PER LARTHE MAGIORE
COME PER LA COMVNE

TEMPVS
GIVGV
VRA
DOMA

Title page of the "Plictho," the first book on European practices in dyeing, originally published in Venice in 1540. For nearly 200 years it was looked upon as an authoritative work.

simply retranslations or digests of a few important works published throughout the centuries. The main story of the development of dyeing from the earliest times down to the middle of the last century, therefore, can be traced by the study of a relatively small number of original key works—thirteen, to be exact, if we include bleaching.

These books were published in many editions, translated into many languages, digested and twisted around and often republished as the work of different authors. Not only did these key books have an important place in the history of dyeing and bleaching, but the authors themselves were generally key figures in the development of new ideas, even in chemistry, economics and politics.

A few of these are fairly common today. Some exist in second or third editions which are certainly satisfactory for study. But many are now almost unattainable. Their titles and a few details about them are given below.

The Thirteen Key Books

Rosetti, Gioanventura

Plictho de larte de tentori che insegna tenger pani telle banbasi et sede si per larthe magiore come per la commune. Venice: 1540.

Other editions: Venice, 1548, 1565, 1611, 1672.

This is the first printed book on dyeing as it was done in Europe. The "Plictho" describes the formulae and techniques used in the most famous dyehouses of Europe and the Near East. Hundreds of recipes for dyeing various colors on different fibers and on leather are given. In the Venetian dialect of the day, the word "Plictho" meant a communication or instruction. This book was of practical importance to dyers for almost two hundred years after its first publication.

Instruction Générale

Instruction générale pour la teinture des laines et manufactures de laine de toutes couleurs, & pour la culture des drogues ou ingrediens qu'on y employe. Paris: 1671.

Other editions: "Le Teinturier Parfait," Leyden, 1708. Paris, 1716. "Ars Tinctoria Fundamentalis" (German translation by G. E. Stahl), Frankfort and Leipzig, 1683. English translation: Part II of "The Whole Art of Dyeing," London, 1705.

Lawrie claims only editions of 1669, 1672, 1708 and 1737, and attributes the work to Colbert assisted by D'Albo. Internal evidence indicates that the edition of 1671 is the first edition.

Edward Bancroft, in the 1813 edition of his work on permanent colors, writes: "This set of regulations was brought out by the French Minister Colbert, not only to inform, but as a Legislative Act, to control the dyers in their operations." The dyers at that time were divided into two classes: dyers "en grand," who were confined to permanent colors, and dyers "en petit teint," who were allowed to use only fugitive colors. The dyes and chemicals to be employed by each branch were specified.

This volume, with its precise regulations, laid the foundation for the great dyeing industry in France.

Hellot, Jean

L'art de la teinture des laines, et des étoffes de laine, en grand et petit teint, avec une instruction sur les debouillis. Paris: 1750.

Other editions: Paris, 1786. Verona,

Italy, 1791. Altenberg, Germany, 1765. Part I of "The Art of Dyeing Wool, Silk and Cotton," London, 1789.

Claude Berthollet, in the 1824 English translation of his great work (see below), said that Hellot's "methodical description" of the dyeing of wool still forms "the best treatise we possess on this subject."

Home, Francis

Experiments on bleaching. Edinburgh, 1756.

Other editions: Dublin, 1771. German translation: Leipzig, 1777. Spanish translation: Madrid, 1779.

This book paved the way for the great chemical advances in the art of bleaching which took place at the end of the 18th century.

Macquer, Pierre Joseph

Art de la teinture en soie. Paris (?): 1763.

Other editions: Berlin, 1764. Dordrecht, 1791. Part II of "The Art of Dyeing Wool, Silk and Cotton," London, 1789.

This was published as part of "Descriptions des Arts et Métiers." Claude Berthollet, in "Elements of the Art of Dyeing," London, 1824, reports that Macquer gave an exact description of the dyeing of silk, that he made known the coloring principle of Prussian blue and tried to apply its use to dyeing, and he further described how to impart brilliant colors to silk by means of cochineal.

Delormois

L'art de faire l'Indienne á l'instar d'Angleterre, et de composer toutes les couleurs, bon teint, propres a l'Indienne. Suivi de la façon de faire toutes les couleurs en liqueur, pour peindre sur les étoffes de soie, pour la mignature, le lavis des plans, & pour colorer les bois, les plumes, la paille, le crin, etc. Paris, 1770.

Other editions: Paris, 1786, 1790. Florence, 1771. Venice, 1775.

This is the best early book on calico printing.

Le Pileur D'Apligny

L'art de la teinture des fils et étoffes de coton, précédé d'une théorie nouvelle des véritables causes de la fixité des couleurs de bon teint, & suivi des cultures du pastel, de la gaude & de la garance. Paris, 1776.

Other editions: Paris, 1798, 1801, 1807. English translation: Part III of "The Art of Dyeing Wool, Silk and Cotton," London, 1789.

Although Le Pileur's book lacked success (for the cotton industry was too young), it was the first to give an accurate description of Indian red, which was then being widely used in Rouen.

Berthollet, Claude Louis

Essay on the new method of bleaching, by means of oxygenated muriatic acid; with an account of the nature, preparation and properties of that acid, and its application to several other useful purposes in the arts. Translated from the French by Robert Kerr. London, 1790.

This is the first book on bleaching with chlorine.

Berthollet, Claude Louis

Eléments de l'art de teinture. Paris, 1791.

Other editions: Second, with A. B. Berthollet, Paris, 1804. First English: Translated by William Hamilton, London, 1791. Other English translations, Edinburgh, 1792, 1793. English translation of second French edition by Andrew Ure, London, 1824 and 1841; first German translation by Hermbstadt, Berlin, 1806.

Bancroft, Edward

Experimental researches concerning the philosophy of permanent colours; and the best means of production, by dyeing, calico printing, &c. Vol. I, London, 1794.

Other editions: London, 1813 (with added notes and an additional volume). Philadelphia, 1814. Berlin, 1817-18.

Chaptal, Jean Antoine Claude

L'art de la teinture du coton en rouge. Paris, 1807.

Other editions: Aarav, 1807. Leipzig, 1807.

Cotton dyeing was still comparatively rare and was considered a difficult process, confined to only a few colors. Chaptal made experiments which resulted in the first publication to take account of the special nature of cotton as a vegetable fiber.

Persoz, Jean François

Traité théorique et pratique de l'impression des tissus. 4 volumes. Paris, 1846.

Other editions: Weimar, 1848, 1852.

This is the classic work on textile printing, issued only shortly before the introduction of the coal-tar dyestuffs.

(*Concluded on page* 101)

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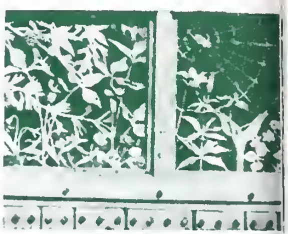

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(*Continued from page* 100)

Dumas, Jean-Baptiste

Précis de l'art de la teinture. Paris, 1846.

This is the eighth and last volume of Dumas' "Traité de Chimie Appliquée aux Arts" begun in 1828.

Other editions: Nuremberg, 1850. Madrid, 1848.

This work contains detailed references to the literature, an unusual feature for a book on dyeing. It has a clear scientific outlook and presents both theory and practical formulas. ◆

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MORE ABOUT THE STOLEN BONSAI

IN THE 1962-63 year-end issue of PLANTS & GARDENS, Mr. George Hull gave an account of the bonsai theft which occurred at the Botanic Garden on the night of September 4, 1962. The story and a picture of the stolen tree appeared in the New York papers on November 23, and the Associated Press carried the story on its wires throughout the nation. It became front page news everywhere in the country, and even in Japan; television news programs also carried it. We estimate that more than twenty million people heard about bonsai for the first time, whereas not more than three or four million at most knew what the word meant before. Thus, in an unfortunate sense, the incident became one of the most highly publicized educational items ever to reach the public.

What has happened since? In mid-May, 1963, reliable information was received as to the probable identity of the thief, and the case was turned over to the Office of the District Attorney of the Borough of Brooklyn. Two detectives were assigned to the case and within a few weeks the place of hiding for the bonsai pine was definitely established. To tighten legal aspects of the case, the thief was led to steal a second bonsai. He was apprehended as he handed the specimen over the Botanic Garden's high iron picket fence to his accomplice in the early hours of July 27, 1963. According to the thief's account, there had been a fire in his Greenwich Village apartment on the night of July 4, and he stated that he took the plant down the fire escape to the second floor, from where he threw it to the ground. To some extent his story was corroborated, but the possibility remains that the bonsai is still alive *somewhere*.

The case came before Judge Julius Helfand, and although the youth was judged guilty of grand larceny, probation was arranged and restitution payments are being made to the Botanic Garden. These started in January, 1964. When the sum of $1,000 has been reached, the young man and his accomplice will be off probation.

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The Year-end 1964-65

This issue marks the close of the 20th year of publication of **PLANTS & GARDENS**, and is the 80th to appear in the series. In the spring of 1945 I remember writing . . . "It is with enthusiasm that we bring you **PLANTS & GARDENS**. It stems by direct descent from the **RECORD**, a 33-year-old publication of the Brooklyn Botanic Garden. . . . We want to tell you the **WHY** as well as the **HOW** of garden practices and link the knowledge of the botanist with the skill of the gardener. . . . Part of our job is to see that the horticultural spring never runs dry, and through research here and elsewhere, we are going to do our best to keep it flowing."

We have tried to live up to the original objectives. Thanks to the warm cooperation of knowledgeable authors all over the United States, Canada, and often other countries, what started humbly, chiefly as a service to Members of our Society here in the metropolitan New York area and the Northeast, has grown to be at least of modest service to the Nation and to 45 countries around the World. Our Trustees and Staff are grateful for the broad participation and interest that have made this possible.

Some of our readers speak of **PLANTS & GARDENS** issues as "pamphlets" or "booklets." Our Editorial Committee would be happier to hear them called "handbooks." They are physically small, to be sure, and they are paperbacks, but the wordage and illustrations of most issues are the full equivalent of many buckram-bound garden books. We are determined to keep the handbooks at a price level where no one is denied them. A share of current gifts from Members of the Brooklyn Botanic Garden, near and far, plus a share of endowment income, is used for the educational program of the Garden. **PLANTS & GARDENS** is an important part of this work.

Despite **PLANTS & GARDENS'** small physical dimensions, a large family of admirers tells us that the handbooks are giants in content; we like to hear this, but continually welcome constructive criticism and suggestions.

Each winter, since the beginning, we have selected articles of outstanding interest and/or significance from other publications, to present in a year-end digest issue. Publishers and authors have cooperated generously in this annual undertaking, and the pages that follow present this year's selections, mostly as condensed versions. These high-merit-of-the-year articles will bring readers a current picture of important developments, mainly as they affect plants of interest in ornamental horticulture.

For important related but non-horticultural contributions, see pages 18, 34, 44, 46, 50.

Sincerely,

George S. Avery, Jr.

Director

P.S. **SEEDS**. Readers of **PLANTS & GARDENS** who might like to grow Butterfly-weed *(Asclepias tuberosa)* are invited to send a stamped, self-addressed envelope for seeds and directions for growing them. This hardy native which blooms from summer to early autumn, thrives from Maine to Florida, and westward. Flowering Dogwood seeds are also available for the asking.

Buhle

'Autumn Snowdrift', a fragrant reblooming iris, photographed in early October

FALL-BLOOMING IRIS

A planting idea for extra flowering

Sarah Hyde Douglas

SOME of the beauty of spring may be recaptured with reblooming, or *remontant,* irises in the garden. Reblooming occurs among certain varieties that grow vigorously, need no summer rest, and do not become unsightly with dying foliage toward the end of the season. To encourage their second flowering, however, a sunny, well-drained location is necessary, with fairly heavy feeding and watering during the summer months.

At the Brooklyn Botanic Garden 'Autumn Snowdrift', 'Gibson Girl' and 'Autumn Delight' bloom continuously from late August through mid-November. Other varieties will rebloom from late July through November, or until heavy frost. Among the most reliable of these are:

Autumn Afternoon
Autumn Elf
Autumn Princess
Autumn Rosemist
Blue Surprise
Double Date
Green Dragon
July Beauty
October Shadows
Persian Pattern
Sally Ann
Summer Pink

Altogether, there are more than 100 varieties of rebloomers for use in various parts of the country, but the source of supply is reported to be quite limited. In fact, Rainbow Gardens, 2036 Carson Road, Placerville, California, is virtually the only nursery handling them in quantity. The late Lloyd Austin, owner of Rainbow Gardens, developed the greater number of the varieties offered in the Rainbow catalog. Some of the others come from Dr. G. Percy Brown of Barre, Massachusetts, who also has plants for sale (summer address: 1603 Main Road, Central Village, Massachusetts). This is a good source for gardeners with a similar climate. On Long Island, Harry B. Kuesel, 19 Mary Lane, Greenvale, New York, also offers reblooming iris. Other dealers in these special irises include the Flesh Gardens, P. O. Box 491, Jefferson, Texas, and Melrose Gardens, Route 1, Box 466, Stockton, California.

Few breeders have worked on rebloomers, perhaps because these are not as spectacular as the varieties that flower in great masses in the spring, and only then. But they have a distinctive quality which makes them favorites among those gardeners who know them and grow them.

In the East, Dr. Brown is at present doing the most extensive work in the field. Dr. Brown describes the principal points of his methods of culture below.

Further information on remontant irises comes from Edwin A. Rundlett of Staten Island, New York, in the *Bulletin of the American Iris Society,* and in the book "Garden Irises," (pages 275-281), edited by L. F. Randolph and published by the Society in 1959. In these pages Mr. Rundlett tells of historical beginnings in other countries, American hybridizers, and cultural requirements. He also lists tested varieties.

A national reblooming iris survey to determine which varieties can be grown most successfully in different parts of the country was conducted by Mr. Austin. This information was published in *The Reblooming Iris Reporter* for July 1963 (pages 29-33). ✦

CULTURE OF REBLOOMING IRISES

G. Percy Brown

Condensed from the *Bulletin of the American Iris Society,* April 1964; originally published in *The Reblooming Iris Reporter,* January 1964.

REBLOOMING IRISES need the best culture to rebloom early and well. The iris bed should be in good soil which has not grown irises before. In my climate [Massachusetts] the bed should be protected from west and north winds and have full sunlight morning and afternoon. Afternoon sunlight is the more important. Air drainage should be good in order to prevent damage from early frosts.

Nearby trees can be harmful because of shade and of root competition. A light soil with plenty of humus is ideal. If alkaline it should be only slightly so, and if acid, only slightly so.

In the preparation of my best bed, a four-inch layer of old manure was put down a foot, then a handful of 5-10-10 fertilizer for each square foot was added. Next, unfertilized clean soil was put on so that there would be at least two inches of this soil between the fertilizer and the iris roots. The rhizomes themselves were placed very close to the surface with roots down. They were set 10 inches apart in each row.

There is morning shadow here but full sun afternoons until sunset. In this location my rebloomers open earliest.

My small seedlings are on an open slope facing west. This gives good air drainage that keeps off early frosts. Here there is full exposure to sun and wind. These exposed seedlings must perform satisfactorily or be destroyed, a means of selecting the fittest for further use.

Less watering will be needed if the soil is enriched with plenty of humus and fertilizer. Shallow cultivation after each rain and after each watering leaves a dry top soil or dust mulch that slows evaporation. The addition of liquid fertilizer when watering every two weeks in July and August helps, in my climate and soil. A 5-10-10 formula is best here. Too much nitrogen results in too much leaf growth. In excessively rich soil many sorts will bloom themselves out in the fall, leaving no rhizomes large enough for producing spring blooms. ✦

A BIRD SANCTUARY AND SUNTRAP

Henry B. Aul

Condensed from the New York *Herald Tribune*, Home & Gardens section, November 15, 1964; reprinted by permission

BIRDS ARE so much fun to watch, why not develop a special sanctuary for them complete with berried shrubs and trees, nesting sites and well stocked seed and suet feeders? While you are about it, make it a sanctuary for yourself as well. Birds like to feed in a warm, sunny spot sheltered from cold fall, winter and early spring winds. These, also, are the ideal specifications for a suntrap or outdoor winter lounge where you can spend comfortable, middle-of-the-day hours enjoying the warmth of a bright winter sun. On many home-grounds there is a spot where bird sanctuary and suntrap may be combined.

Southern Exposure

Just such a situation is shown in the accompanying illustration. The garden side of the house faces south, southeast or southwest and a fence of boards and battens, saplings, basket weave or other solid effect is built away from the house to form a snug corner sheltered from cold north, northwest and northeast winds. Columnar tall-hedge buckthorns (*Rhamnus frangula columnaris*) planted back of the fence, on both sides of the corner, add height to the windbreak and are enjoyed by the birds.

Pleasure for Birds and Owners

From the birds' point of view, other enticements are present in the form of berry-bearing trees and shrubs in the shrubbery border that extends away from the fence inclosure and in the well-stocked feeders that are hung from branches or placed on posts or standards in the border. The suntrap corner is paved with flagstones, bricks or concrete blocks to provide a well-drained, dry, warm floor that can be easily cleared of snow. This paving connects with doors leading from the recreation or other living room indoors.

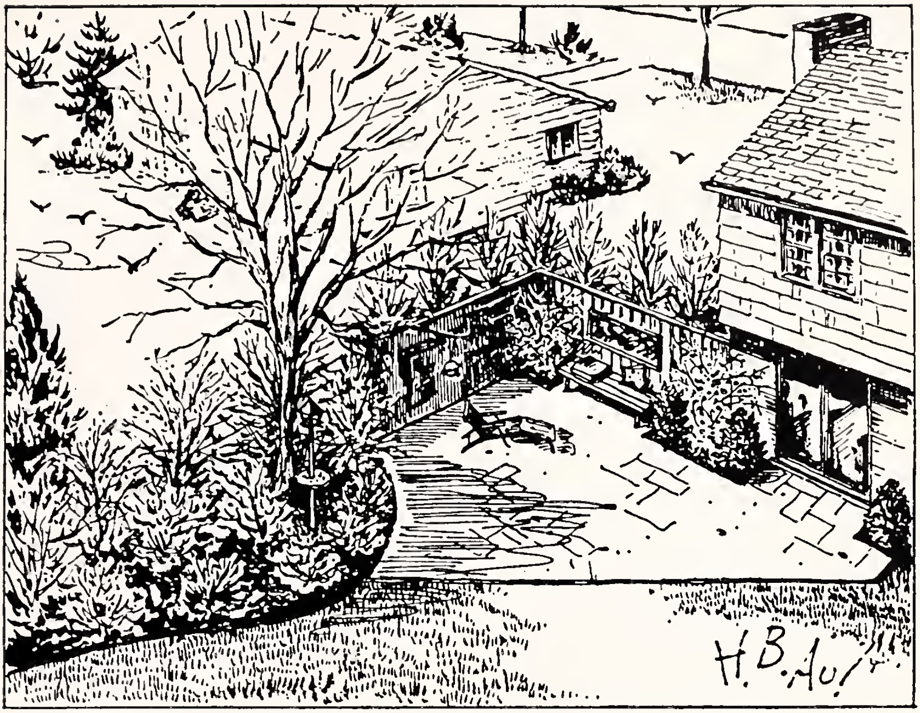
Furnishings for the area should include light-weight lounge chairs that can be quickly folded and put indoors, and at least one amply proportioned bench that can be maintained as a permanent feature, always in place for a restful pause when the sun is shining brightest. The one shown is eight feet long and two feet wide with quarter-inch spacing of the seat boards to afford quick drying of moisture. Cushions or lounge pad are used on this bench.

Mounted on the fence, directly above the bench, a framed panel of plywood or hardboard colorfully depicts conventionalized or abstracted flowers, foliage and even birds. Across the corner, pieces of driftwood and broken sections of weathered boards are mounted on the face of the fence. These can be decorative and also offer interesting cracks and crannies in which to tuck sunflower seeds which will be fun for the chickadees, titmice and cardinals. Suet will attract the nuthatch, creepers and woodpeckers.

Fruit-bearing Ornamentals

The bench and doorway are framed with espaliered bush honeysuckles, firethorn or viburnums and sheared American or Japanese hollies. All are berry-bearing ornamentals that are sought by the birds. In the spring and fall they will attract flocks of cedar waxwings.

The tree planted where it will shade the terrace paving during the summer might be a hackberry if you wish to at-



Design for a bird sanctuary and winter suntrap lounge

tract large numbers of birds. One of the improved honey-locusts would be another good choice for this important spot. It is headed high to permit planting a collection of trees and shrubs around it and extending on out along the property line.

Both the flowering dogwood (*Cornus florida*) and the Chinese dogwood (*C. kousa*) are high on the list of plants with fruits that are sought by the birds. *Cornus mas* and *C. paniculata* are other bush dogwoods to consider. The chokeberries (*Aronia*), including the upright growing one (*A. arbutifolia erecta*), should be given preference, as should both the high- and low-bush blueberries.

Bayberry (*Myrica pensylvanica*), inkberry (*Ilex glabra*) and the black-alder (*Ilex verticillata*) all are choice ornamentals that the birds, also, will enjoy. Among evergreens the improved varieties of the red-cedar (*Juniperus virginiana*), American holly and the various Japanese hollies give a choice. Hawthorns in variety are candidates, as are the fruit-bearing cherries and crab apples.

Japanese and other berry-bearing barberries must be included along with the coralberry (*Symphoricarpos*) and the aforementioned bush honeysuckles and viburnums. Plant strawberries as a ground cover in the foreground of the border. You won't get any berries but the birds will sing for joy.

GREENHOUSE TOWERS

Many advantages claimed for new design

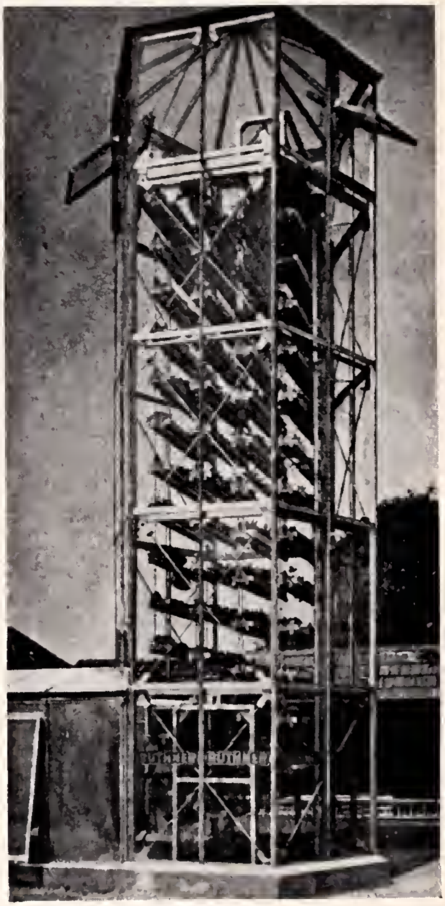
Condensed from the *Gardeners Chronicle*, April 18 and May 16, 1964

THE greenhouse of the future may go upwards instead of covering acres of land. A new tower design incorporates a vertical and horizontal conveyor system which allows full utilization of space for cultivation, and also provides improved aeration and lighting.

A major problem of plant production in some areas, especially in winter, is light deficiency. In a tower house, plants can receive more light because of the height of the structure and the horizontal and vertical movements of the conveyor system. Being in motion, the plants are subjected to a continuous and regular change of light and shade. Favorable air conditions are obtained because the surface of the tower is small in relation to the cultivation area. This results in a reduction of heating and cooling costs. Improved aeration is also obtained because of the chimney effect of the design.

The first tower house, 65 feet in height, was erected in 1963 at Langenlois, about 50 miles from the Austrian border, at a school devoted to the practical training of horticulturists. Before this greenhouse of new design started operation, previous experience had been gained on the conveyor system of plant growing. This brings the plants to the grower, who may remain seated in a convenient position at the base of the tower. All operations, such as planting, watering, feeding, take place at this level. The plants move up and down the whole height of the tower in from one to six hours according to the setting of the mechanical controls.

Hydroponic culture was successfully tested here, and it was found that an ideal situation could be created. A fantastic crop production was shown to be possible on a relatively small ground space.



Tower greenhouse developed by Ruthner's, an Austrian firm, for the cultivation of young seedlings. This structure may be singly or doubly glazed with either polyethylene film or with glass.

A tower greenhouse 130 feet high, with a cultivation area of 10,000 square feet, and with plants growing on 82 levels, was in operation at the International Horticultural Exhibition in Vienna during the summer of 1964. ✦

SYSTEMICS

Are they the answer to garden pest control?

P. P. Pirone

Reprinted from *Horticulture*, August 1964

PRESENT-DAY insect and disease control practices used by arborists, nurserymen, florists and horticulturists may soon be drastically changed by more extensive use of systemic insecticides and fungicides. These are chemicals that can be absorbed either through the roots or leaves of plants and translocated in the sap stream in sufficient amounts to kill insects and related pests feeding or breeding in the plants, or to destroy or slow down the growth of bacteria or fungi infecting them. What they actually do, then, is to kill insects, fungi or bacteria from the inside of the plant rather than from the outside, as do conventional sprays. Systemics are more efficient than chemicals sprayed on the leaves because they spread through the plant as it grows, and do not wash off in rainy weather. Likewise, they present little or no danger to nearby wildlife, unless the plants are eaten. They are now being used primarily by commercial arborists, nurserymen and professional flower growers on *non-food* crops, though a few can be used on nonbearing fruit trees.

Looking Backward

It was Leonardo da Vinci who first considered the possibility of controlling pests with a systemic. Nearly 450 years ago, this famous Italian painter, sculptor, architect, scientist and philosopher believed arsenic to be a promising "systemic insecticide." Only in the past quarter of a century, however, have significant strides been made in perfecting this approach to pest control, the impetus to research on systemics being the discovery that aphids do not attack plants growing in soils containing selenium. The greatest advances in the practical use of systemics resulted from the research conducted in Germany nearly 30 years ago by Gerhard Schrader and his associates, who discovered that an organic phosphate, octamethylpyrophosphoramide (OMPA, for short) could be readily absorbed through roots and leaves of plants, thereby protecting the plants against many kinds of insects and related pests.

General Guidance

Many of the systemics presently available should not yet be used by the usual run of amateur gardeners because of their extreme toxicity. An exception is dimethoate (trade name Cygon 267), considered the safest of the systemic phosphate insecticides, which controls

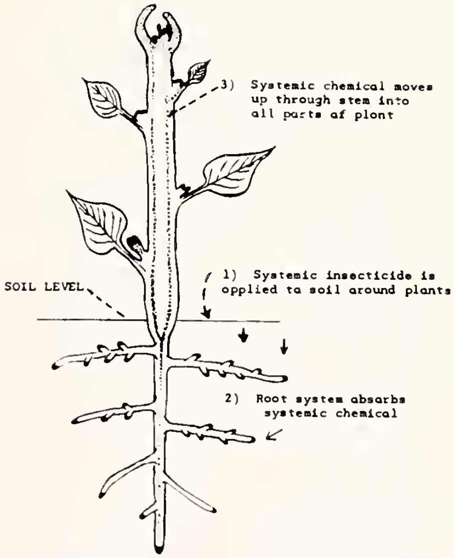

3) Systemic chemical moves up through stem into all parts of plant
SOIL LEVEL
1) Systemic insecticide is applied to soil around plants
2) Root system absorbs systemic chemical

Diagram of plant to show how systemic chemicals 1) are applied to soil around plant, 2) are absorbed by the root system and 3) move into the above-ground portions of the plant—the stems, leaves, etc.

mites, leafminers, whiteflies, lace-bugs and the toughest scales attacking azaleas, camellias and gardenias; mites, aphids and scales on evergreens; leafminers, mealy bugs and mites on boxwood, holly and birch; aphids, mites, thrips and leafhoppers on roses and other flowers. In fact, Cygon has been cleared by the United States Department of Agriculture for control of 25 species of insects attacking 23 kinds of ornamental plants. In addition, its use is even permitted on non-bearing apples, pears and citrus.

Among other systemics available to professional growers are demeton (Systox), Di-Syston (Scope), methyl demeton, Meta Systox-R, schradan (OMPA), and phorate (Thimet).

Uses of Systemic Insecticides

Following are specific uses for some of these materials:

Mimosa webworm, a serious pest of the silk-tree (*Albizzia*) and the honey-locust (*Gleditsia*) in areas from New Jersey west to the Mississippi and south to Georgia and Alabama, can be readily controlled for an entire season by a single soil application of either phorate (Thimet) or Di-Syston carefully worked into the ground around the tree. To control the same pest in the conventional manner, from three to five foliage sprayings are needed each season. The systemic materials, however, must not be allowed to stay on the soil surface because they are very toxic to warm-blooded animals.

The holly leafminer can be controlled by incorporating either Di-Syston or methyl demeton, 5 per cent granules, in the soil beneath the holly trees. Aphids, birch leafminer, lace-bugs, mites and hoppers on woody plants can be checked by applying Di-Syston, 10 per cent granules, to the open soil beneath trees and then working it into the soil and watering thoroughly. Phorate (Thimet) 10 per cent granules, provides excellent control of leafminers in boxwood, birch and holly. It is applied at the rate of 60 pounds per acre as a side dressing in nursery rows and worked into the soil. For controlling aphids, leafhoppers, thrips, and mites on flower crops such as carnations, chrysanthemums, and dahlias, the Thimet granules are applied to the soil surface and watered in immediately. A single application will protect these flowers from sucking insects and mites for several weeks.

Scope (a trade name for Di-Syston) liquid and granules (available to the general public) give protection for at least six weeks against aphids, mites, thrips, leafhoppers and various other insects.

Another interesting way to apply a systemic has recently been reported. Bidrin, a new systemic, is inserted into 1-inch deep holes drilled into the main lateral roots of trees. One pint of Bidrin will treat about 50 honey locusts, 5 inches in trunk diameter and protect them from the mimosa webworm for an entire season.

For greenhouse grown plants, the following dosages of systemic insecticides are used safely when applied to moist soils. Two applications at 10 to 14 day intervals provide best control.

For roses, chrysanthemums, carnations, and snapdragons use demeton (Systox) ½ pint; or schradan (OMPA) 1 pint per 1000 square feet in not less than 10 to 15 gallons of water.

For treating potted plants such as African violets, cyclamen and foliage plants, the following dosages are suggested. Using the systemic demeton, mix 4 tablespoons in 25 gallons of water or ½ teaspoonful in 1 gallon. A 4-inch pot requires ¾ cup of the solution. Using schradan, the mixture rates are the same but a 6-inch pot requires one cup of solution.

Sodium Selenate

Sodium selenate is not used as extensively by commercial growers today because many of the newer systemics have been found to do a better job on a wider range of plants. Some commercial florists still use it to control pests on herbaceous plants such as African vio-

(*Concluded on page* 13)

SYSTEMICS AND HONEY BEES

A few facts and a word of caution

Jerry T. Walker and George Kalmbacher

THE POSSIBILITY of poisoning honey bees should be an important concern when using systemic pesticides on plants that are in bloom. Systemic pest control chemicals do their work by becoming distributed throughout the plant, thus they are present in all flower parts as well as in roots, stems and leaves. A systemic pest control chemical applied during the flowering period can, therefore, be disastrous or at least hazardous to bees, in accordance with its degree of toxicity.

Sprays

In 1964, a report dealing with several systemic materials indicated that spray applications of Cygon (0.1% dimethoate) to bluebell, rape and borage produced nectar that was toxic to bees for at least three days after application; another systemic, in eight times this concentration (0.8% phosphamidon) was non-toxic. Thus systemic materials differ in their capacity to poison bees, yet are apparently equally effective in their control of insect pests.

Soil Applications

In general, granular insecticides are less likely to cause bee losses than spray applications. Nevertheless, soil applications of 4 pounds per acre of granular Cygon, accompanied by a thorough watering, brought about toxicity of nectar for at least four days after application. Nectar from plants growing in soil treated with phosphamidon in increasing amounts was not toxic to bees until the application rate of 32 pounds per acre was reached. With this amount, the nectar became toxic three days after application and remained so for three additional days.

When to Treat

It is obvious that, to be effective, a systemic insecticide must be present in the tissues of the plant when the pest is actively feeding. At the same time, only systemics demonstrated to be non-toxic to bees should be applied during the flowering season. Since some systemic sprays cause "knockdown" of bees, soil applications are recommended. And for a margin of safety, these should be made not less than ten days before flowering commences.

Insofar as bees are concerned, systemic chemicals may be used at any time on wind-pollinated plants. It is therefore important to distinguish between plants that are wind-pollinated and those that depend on insects.

Distinctions

Oak trees are wind-pollinated. Their flowers are not visited by bees or other pollinating insects, so presumably there would be no bee problem when treating oaks with systemics of any kind. The same would be true of birches, poplars, willows, beeches, elms, and alders, also such shrubs as sweetfern and bayberry. Pines, firs, spruces, junipers, hemlocks and other members of the Pine Family are also wind-pollinated. All these plants have small, inconspicuous flowers or cones. In contrast, the flowers that pollinating insects visit are conspicuous. Among flowering trees and shrubs, examples are catalpa, horse-chestnut and lilac. Virtually all garden annuals and perennials are insect-pollinated. On these the use of systemics could be hazardous for bees. ✦

HONEY-LOCUST PEST YIELDS TO SYSTEMICS

David E. Donley

Condensed from *American Nurseryman,* June 1, 1964

THE MIMOSA webworm (*Homadaula albizziae*) is a serious pest on thornless varieties of honey locust (*Gleditisa triacanthos*). Since it was first found in the United States in 1942, this pest has established itself over a wide area. Two factors have forced nurserymen to combat it throughout the growing season.

First, the area in which the thornless kinds are grown falls within the geographic range of native honey locust. So, the honey locust trees found along fencerows, road margins and on abandoned agricultural land are a vast reservoir from which mimosa webworm spreads to plantings of the thornless ornamental clones. Second, the pest produces two to four generations each year. After the overwintering brood lays its eggs, all stages of the insect from egg to adult can be found on trees at the same time.

Foliar sprays kill larvae but have little effect on eggs or adults. To protect trees from being defoliated by larvae hatching later, the sprays must be applied three to five times during the growing season. There are several foliar sprays available to nurserymen. These sprays contain DDT, Sevin, lead arsenate, Trithion, dieldrin or toxaphene.

Systemic treatments to control mimosa webworm are also available. With these, a single application will protect trees all season. Individual trees can be treated and different quantities of such systemic insecticides as Di-Syston, phorate (Thimet), or Bidrin (SD 3562) applied per tree.

Systemics in Granular Form

After several years of experimentation by the Central States Forest Experiment Station, we obtained good results by applying Di-Syston or phorate (Thimet) granules in spring or early summer at the rate of eight pounds of the technical insecticide per acre, then cultivating granules into the soil. Either systemic gave season-long protection to nursery plantings of thornless honey locust.

1959 Experiments

In 1959, at Dayton, Ohio, several systemic insecticides were applied to some individual trees of the Moraine selection of thornless honey locust. Treatments included soil drenches and granular applications. All materials were applied directly to undisturbed soil or were placed in a shallow circular trench 2 inches wide and 4 inches deep and dug 24 inches away from the tree's base.

The trees became naturally infested with webworm larvae. But in addition, 20 to 25 live larvae were placed on the trunk of each tree at 2-week intervals after systemic treatment. These larvae were allowed to migrate to the foliage. Webs per tree were counted at 14-day intervals after treatment, and per cent of defoliation was estimated weekly. When applied as soil drenches, materials were ineffective, phytotoxic or too dangerous to use. On the other hand, most granular materials showed promise.

1961 Experiments

By 1961 it was decided that we should evaluate Di-Syston and phorate (Thimet) at both four pounds per acre, a rate that had produced sporadic control, and also at eight pounds per acre, a rate that had given good control in a variety of situations. The insecticides in granular form were applied with a fertilizer spreader. A face mask was used while handling the granules, loading the spreader and making the application. Granules were spread in a band 24 inches wide on both sides of each row of trees. The entire area between the rows was then cultivated.

To get some idea of the hazard to birds, we left one set of treatments uncultivated for 48 hours. Many birds were observed picking up the granules and some were later found dead or "intoxicated" on this and adjacent plots. No dead birds were found on the cultivated plots and birds continued nesting in the area throughout the summer. The control results at Dayton and Circleville were similar. Both early and late applications provided season-long protection.

Conclusions

Results show that either Di-Syston or phorate (Thimet) will control the mimosa webworm and prevent defoliation of thornless honey locust. A single application of eight pounds per acre in spring or early summer will provide season-long protection. The best results were obtained by applying a granular formulation in a 24-inch-wide band on both sides of each tree row and following this by cultivation.

The systemic insecticides Di-Syston and phorate (Thimet) are extremely toxic to humans. Protective clothing, including a face mask, should be used when handling the insecticides, when treating nursery rows or when cultivating immediately after treatment. Label recommendations on use and precautions should be strictly followed.

SYSTEMICS

(*Continued from page* 10)

let, cyclamen, delphinium, chrysanthemum and foliage plants. Moreover, sodium selenate is highly toxic to people and pets. In fact, *it should never be used in soil that is to grow food plants!*

Sodium selenate is available for the amateur grower in capsule form under the names Kapsulate and Sel-Kaps for the control of pests of African violets, and in a 2 per cent concentration, absorbed on superphosphate, under the name P-40, for direct application to soils in which chrysanthemums are growing. P-40 will control sucking insects and the destructive leaf nematode which attacks chrysanthemums.

Systemic Fungicides

Although few systemic fungicides (chemotherapeutants) are available at present, many promising ones are being investigated. When introduced into the plant they act in one of several ways. Some antidote the toxins produced by the parasite, others reduce or retard the growth of the parasite, and still others modify the cellular structure of the plant, thereby slowing down the growth of the parasite.

Blister rust, one of the most destructive fungus diseases of five-needled pines, is now being combatted successfully with the antibiotic cycloheximide (Actidione). When sprayed on the lower portion of the tree, the antibiotic is absorbed and translocated upward to kill lethal blister rust cankers in trees up to 50 feet tall. The treatment has been used successfully on Western white pine (*Pinus monticola*). Cost of treatment per tree ranges from two to ten cents depending upon the tree's size. Actidione B.R., as it is now called, has been tested for the past 10 years on more than four million trees in the Pacific Northwest. Detectable amounts of Actidione were present in the foliage of 20-year-old Douglas fir trees six months after 100 parts of Actidione in one million parts of fuel oil had been sprayed on trunks.

Some research workers consider it quite possible that a systemic fungicide will soon be found that is capable of controlling such highly destructive diseases as chestnut blight and Dutch elm disease.

In any case, the systemic insecticides and fungicides hold great promise for the future and it is altogether possible that some will be introduced that can be used much more widely than most of our present ones. They will certainly bear watching by all good gardeners. ✦

PLANT FORMS FOR LANDSCAPE EFFECTS

Selections can be made to suit the surroundings and to create a mood

Clarence E. Lewis

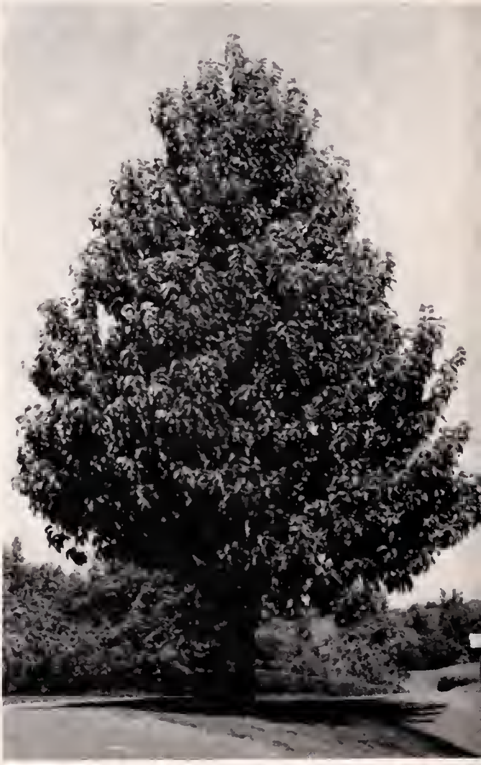
Condensed from *American Nurseryman*, September 15, 1964
Photographs by the author

PLANT forms can be as prominent as exclamation points, or more subtly painted into a composition so that the picture looks like a unit rather than a series of undetermined decisions.

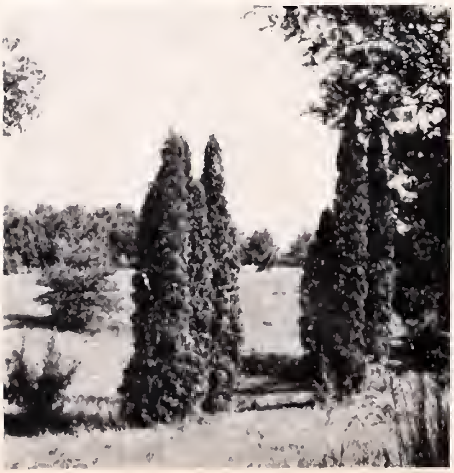
Vertical lines or forms are not the simplest to use, but they can be made integral parts of a design in such a way that they are pleasant and acceptable. There is nothing objectionable in grouping columnar forms, and plants handled in this manner are likely to have more appeal than single specimens.

Wide-spreading forms and low, broad or trailing ones have places of their own in the planned landscape. The photographs on these two pages suggest some appropriate uses of these less conventional forms in woody plants.

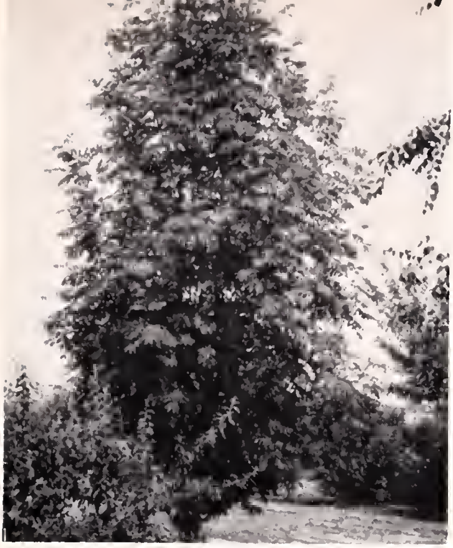
[For good placement of other fine forms of narrowly upright trees, see the next two pages.—Ed.]



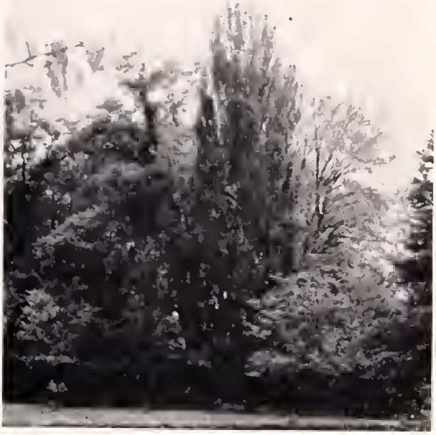
The large leaves and sturdy stature of a cucumber-tree (*Magnolia acuminata*), like the 40-year-old specimen shown here, make it "king of the hill." One cannot look through its dense greenery.



Tall slender trees like the American arborvitae (*Thuja occidentalis*), at left, are better used in groups than singly. Here these 25-year-old plants add a pleasing note to the assemblage. The larger trees at the right keep the arborvitaes from dominating the scene.

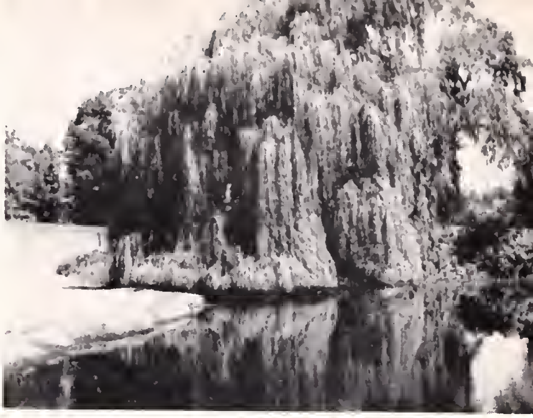


The fastigiate European mountain-ash (*Sorbus aucuparia fastigiata*), above, though only 15 years old, differs sharply from the cucumber-tree at left. Its leaves are more delicate and there are small openings between branches which reveal the sky.

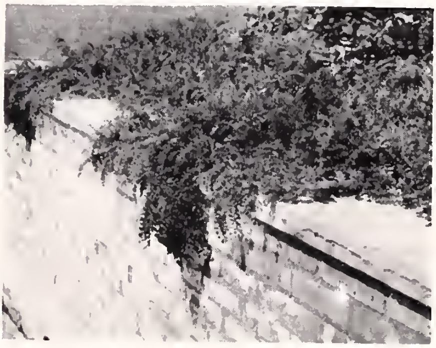


The columnar European beech (*Fagus sylvatica fastigiata*), above, which is close to 70 years old, would appear harsh if it stood alone. It is graced, here, by the surrounding trees of unequal heights and shapes.

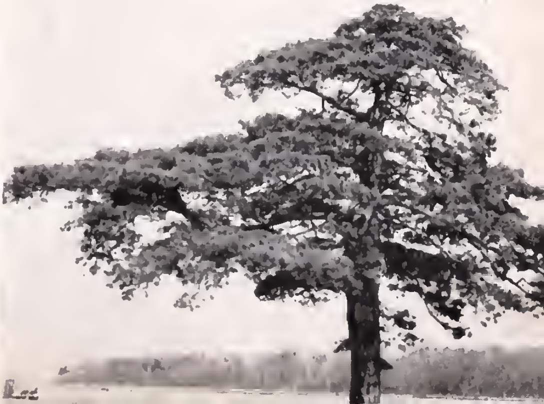
A Scots pine (*Pinus sylvestris*) with wide-spreading branches like this 40-year-old tree, at right, in an open field, would make a priceless specimen for a broad lawn. Such tree forms can be created by planned pruning when the trees are young.

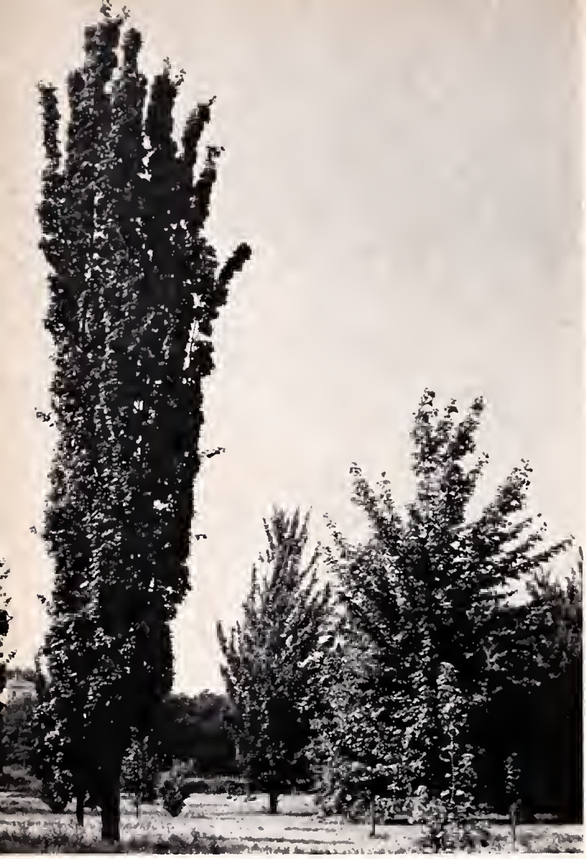


The pendulous branches of the weeping willow (*Salix babylonica*) give a restful effect. Their way of seeming to seek and find the ground within their own immediate area, as this tree has been doing for over half a century, suggests that the spot where they are growing is right for them.



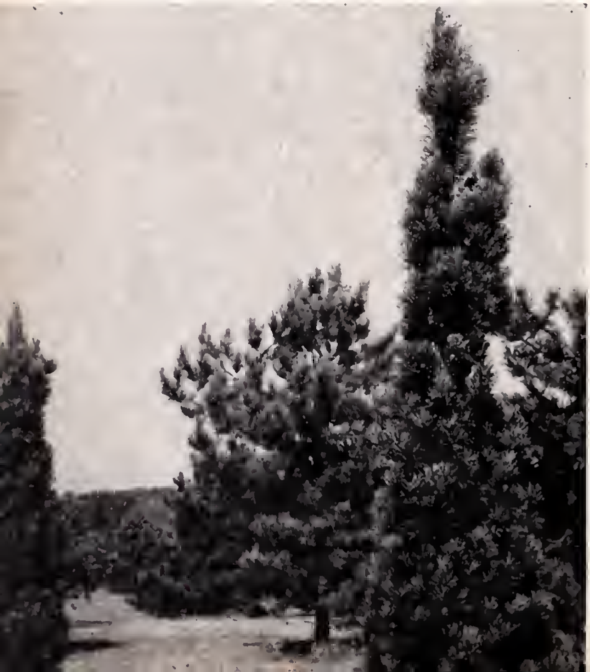
Branches of this 6-year-old creeping cotoneaster (*C. adpressa*) serve as a ground cover, and successfully soften the lines of the wall.





Narrowest of the maples is 'Temple's Upright', a variety of sugar maple (*Acer saccharum*) formerly known as *monumentale.*

Hardy and handsome is the narrow, pointed variety of the Scots pine (*Pinus sylvestris* 'Fastigiata'). These are 20-foot trees.



FASTIGIATE TREES

Donald Wyman

Condensed from *American Horticultural Magazine,* October 1964

Photographs taken at Arnold Arboretum, Jamaica Plain, Massachusetts

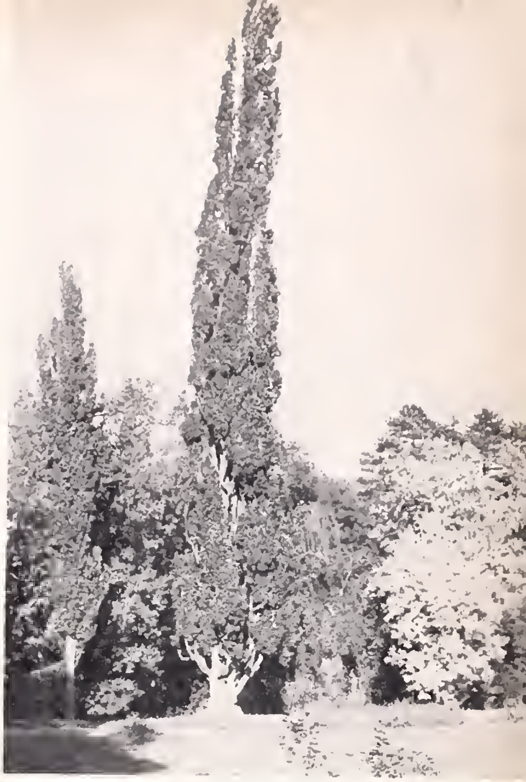
FREQUENTLY one needs to plant one or more fastigiate (narrowly upright) trees in the garden for some very special purpose. These may be difficult to find in small, local nurseries, but of the sixty or more being grown in the Arnold Arboretum in Jamaica Plain, Massachusetts, at least forty are available from some nursery in America. Of course it is possible by continual shearing to make a columnar mass of foliage out of almost any tree, but the older and larger the tree becomes, the more difficult and time-consuming is the task of shearing. It is far better to obtain the normally fastigiate tree, the one that naturally grows with a slender, upright habit, and there are enough kinds of these to supply any reasonable need.

Fastigiate trees differ materially in their respective habits and in the way in which they grow over the years. Some, like the maples, will retain their narrow habit throughout their normal life span. Others, such as the narrow varieties of *Malus, Cornus* and *Sorbus,* will not. As youthful trees they are excellent, but as columnar specimens they fail miserably when mature. The simple fact is that as the upright branches grow longer and longer, and the trees bear heavier and heavier crops of fruits, the branches are bent, sometimes almost to the horizontal. There comes a time when these trees take on the normal, wide-spreading habits of the species.

RECORD OF FASTIGIATE TREES

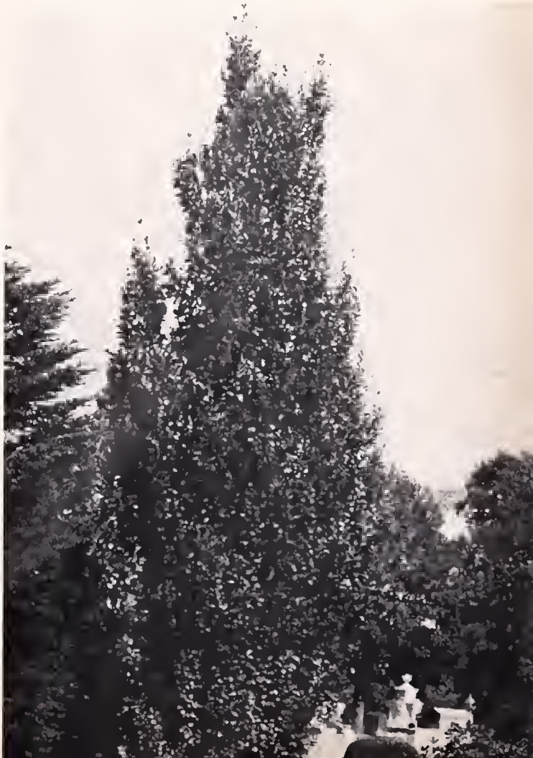
NOTE: Where age is listed, the tree is currently growing at the Arnold Arboretum.

	Height (estimated)	Diameter of Branch Spread	Age	Estimated Possible Mature Height
Acer platanoides 'Columnare'	30′	16′	39	90′
Acer platanoides 'Erectum'	35′	9′	34	90′
Acer pseudoplatanus 'Erectum'				90′
Acer rubrum 'Columnare'	90′	25′	64	120′
Acer saccharum 'Temple's Upright'	75′	15′	69	120′
Acer saccharum 'Newton Sentry'	75′	20′	42	120′
Betula pendula 'Fastigiata'	32′	10′	20	60′
Carpinus caroliniana 'Pyramidalis'	18′	6′	21	36′
Carpinus betulus 'Columnaris'	30′	12′	30	60′
Carpinus betulus 'Fastigiata'	30′	30′	42	60′
Cercidiphyllum japonicum (one trunk)	40′	15′	18	75′
Cornus florida 'Fastigiata'	25′	25′	25	25′
Crataegus monogyna 'Stricta'	6′	4′	13	30′
Crataegus phaenopyrum 'Fastigiata'	10′	4′	15	30′
Fagus sylvatica 'Fastigiata'	60′	20′	50	90′
Ginko biloba 'Fastigiata'	60′	15′	.	120′
Koelreuteria paniculata 'Fastigiata'	9′	2′	5	30′
Liriodendron tulipiferum 'Fastigiatum'	75′	30′	65	150′
Malus baccata 'Columnaris'	12′	15′	10	50′
Malus prunifolia 'Fastigiata'	10′	6′	11	20′
Malus robusta 'Erecta'	10′	6′	11	40′
Malus 'Van Eseltine'	8′	4′	13	25′
Populus alba 'Pyramidalis'	40′	12′	....	90′
Populus nigra 'Italica'	40′	9′	....	90′
Populus simonii 'Fastigiata'	25′	20′	14	50′
Populus tremula 'Erecta'	18′	3′	25	75′
Prunus sargentii 'Columnaris'	15′	10′	29	75′
Prunus serrulata 'Amanogawa'	15′	4′	15	20′
Quercus robur 'Fastigiata'	25′	10′	33	75′
Robinia pseudoacacia 'Erecta'	18′	12′	13	50′
Sorbus aucuparia 'Fastigiata'	25′	15′	13	45′
Taxodium ascendens	30′	9′	58	75′
Taxodium distichum	30′	12′	30	150′
Tilia americana 'Fastigiata'	16′	3′	12	120′
Tilia cordata 'Swedish Upright'	35′	12′	58	90′
Tilia platyphyllos 'Fastigiata'	7′	3′	10	120′
Tilia tomentosa 'Erecta'	6′	3′	6	90′
Ulmus americana 'Ascendens'				120′
Ulmus americana 'Augustine'	30′	15′	15	120′
Ulmus americana 'Columnaris'	80′	25′	41	120′
Ulmus americana 'Fiorei'	15′	1½′	6?	120′
Ulmus americana 'Lake City'	80′	30′	33	120′
Ulmus americana 'Moline'	40′	30′	37	120′
Ulmus americana 'Princeton'	40′	30′	29	120′
Ulmus carpinifolia 'Dampieri'	30′	20′	56	90′
Ulmus carpinifolia 'Sarniensis'	75′	25′	61	90′
Ulmus glabra 'Exoniensis'	7′	3′	13	120′
Ulmus procera 'Viminalis'	12′	4′	13	120′
Evergreen Trees				
Chamaecyparis lawsoniana	24′	8′	65	120′
Chamaecyparis lawsoniana 'Allumii'	6′	4′	11	120′
Chamaecyparis lawsoniana 'Erecta'	20′	8′	24	120′
Chamaecyparis lawsoniana 'Fletcheri'	12′	6	....	?
Chamaecyparis obtusa 'Erecta'				120′
Cupressus sempervirens 'Stricta'	25′	3′	....	75′
Juniperus chinensis 'Columnaris'	8′	4′	8	60′
Juniperus chinensis 'Mas'	30′	12′	45	60′
Juniperus chinensis 'Pyramidalis'	6′	4′	15	60′
Juniperus virginiana 'Pyramidalis'	30′	10′	62	90′
Juniperus virginiana 'Schottii'	20′	12′	63	90′
Libocedrus decurrens	60′	25′	65	135′
Picea abies 'Columnaris'				150′
Pinus cembra	15′	8′	45	75′
Pinus strobus 'Fastigiata'	60′	30′	67	100′
Pinus sylvestris 'Fastigiata'	20′	4′	....	75′
Pseudotsuga menziesii 'Fastigiata'	6′	3′	12	120′
Taxus baccata 'Stricta'	30′	12′	....	60′
Thuja occidentalis 'Douglasii Pyramidalis'	9′	6′	12	60′
Thuja occidentalis 'Fastigiata'				60′
Tbuja plicata 'Fastigiata'				150′
Tsuga canadensis 'Kingsville'	18′	3½′	....	90′



The English oak in its extremely narrow variety (*Quercus robur* 'Fastigiata') furnishes seedlings 80 per cent true to form.

The fastigiate beech (*Fagus sylvatica* 'Fastigiata') retains its narrow form throughout its life. Like the oak above, it is long-lived.



PLANTS TRAP FALLOUT

Radioactive debris is held in alpine tundra

John A. Osmundsen

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UNIVERSITY OF Colorado scientists have found that the conditions in the alpine tundra of the mountains near there are ideal for trapping radioactive fallout.

This finding has come from what is believed to be the most thorough field study of fallout patterns and processes ever conducted.

Now nearing completion, the study is being made in one of the heaviest fallout regions in the world, which is also the watershed for Boulder, Colorado, a city of about 45,000 persons.

The Atomic Energy Commission began in 1956 a study of fallout patterns in the area.

Radioactivity Measured

Some 22 stands, or vegetation types, of plants were classified, mapped and measured for their productivity and their radioactivity, mainly from electron-emitting fallout products, or nuclides. Some gamma ray measurements were made.

A few months ago, uptake of these fallout products by animals was also measured. Other data on meteorological conditions came from the Arctic and Alpine Institute's routine operations.

Essentially, what the scientists found was that the alpine tundra is extremely effective in concentrating fallout.

For example, after the Soviet Union broke the test ban in the fall of 1961, water running off snowfields in the ridge was found to register from 3,000 to 4,000 picocuries' worth of radioactivity. A picocurie is a million-millionth of a curie, the amount of radiation given off by a gram of radium.

When it passed through sedge mats at the base of those snowfields, the radioactivity was reduced to 30 to 40 picocuries, an amount within recognized acceptable limits.

Similarly, debris on the forest floor and sphagnum moss bogs down the ridge were found by the scientists to trap most of the fallout they were exposed to by chemical, mechanical and biological processes.

City Reservoirs Benefit

So effective was the trapping process that water in the mountain weir, before it runs into the city reservoirs, was lower in radioactivity than that that came out of the city taps. More fallout was picked up in the reservoirs after the water had come down.

However, the levels were still exceedingly low, the scientists said.

Fallout that is not trapped in this manner, it was observed, may leave in a variety of routes, including natural decay and on, or in, insects and other animals that pass through the region.

Despite the high amount of concentration of fallout, the scientists said they have observed no deleterious effects on any living thing. But they concede they do not always know what is normal and what is abnormal in the alpine tundra.

Analysis Being Made

Data on these matters as well as on the distribution of various nuclides are now being analyzed by computer.

From that analysis, which is scheduled to be completed in a few months, the scientists hope to establish some guidelines as to what environmental conditions hold greatest promise for canceling out the effects of radioactive fallout. ◆

PLANT HARDINESS AND TOUGHNESS

A symposium by experts in western and eastern states

FACTORS that help plants endure vicissitudes of weather (droughty summers as well as frigid winters) are discussed in the next three articles by plantsmen with different backgrounds. J. Harold Clarke, who formerly taught horticulture at Rutgers University, New Brunswick, New Jersey, now raises rhododendrons in western Washington. Robert G. Mower is a professor of horticulture at Cornell University, Ithaca, New York. E. Sam Hemming is the proprietor of Eastern Shore Nurseries, Easton, Maryland.

WHAT DOES HARDINESS MEAN?

J. Harold Clarke

Condensed from *Horticulture*, December 1964

HARDINESS means many things. In many cases it has nothing to do with temperature but rather with general "growability." To the gardener, however, hardiness usually means resistance to low temperatures, and that is the way the term is used here.

Even when we are speaking of resistance to low temperature, hardiness means different things to different people. In our Long Beach, Washington, area a plant might be considered hardy if it withstands 10 degrees above zero. An Easterner might think 30 below was about the minimum which a plant might endure, and there are records of plant resistance to 60 below.

The degree of cold a plant can resist and still be uninjured varies greatly with different kinds of plants; with different individuals of the same kind of plant; and even with the same individual plant from one time of the year to another. This subject has received much attention from research workers because low temperature is the greatest plant killer with which the average gardener has to contend.

There have been recent attempts to organize the available information about hardiness. One method has been the making of hardiness zone maps, with lines intended to divide the country into zones having essentially the same minimum temperatures. With such maps it has not always been possible to consider, in addition to latitude, such factors as altitude, distance from the ocean or large lakes and sheltering effect of mountain ranges.*

In hilly country the temperature may vary greatly within distances too small to show on a map. People who garden in hilly areas know that temperature may vary several degrees from one part of the garden to another. There may be frost pockets; exposed areas where plants will be injured on a cold, windy night; and protected areas where the more tender subjects can be planted.

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*The Plant Hardiness Zone Map published by the United States Department of Agriculture (as Miscellaneous Publication number 814) and sponsored by the American Horticultural Society, is based on extensive data accumulated and interpreted by Dr. Henry T. Skinner, Director of the United States National Arboretum, Washington, D. C. This map, a helpful reference work for the gardener, is sold for 15 cents by the Superintendent of Documents, United States Government Printing Office, Washington, D. C. 20402.

Hardiness ratings for rhododendrons have been compiled and published by the American Rhododendron Society in "Rhododendrons for Your Garden" ($6.95), available from Dr. Clarke at Long Beach, Washington.

Plants which have been growing locally for a number of years, without winter damage, can generally be considered hardy. However, gardeners are usually more concerned about new plants for which there is no local basis of experience. Neither a zone map nor hardiness ratings give all the answers.

Heredity Involved

Resistance to cold is a plant characteristic governed by heredity, and probably affected by several different genes. One set of genes may control the type of growth of the plant. It may, for instance, be low and spreading so that it avoids a certain amount of wind, and is in a good position to receive radiant heat from the earth during frost periods. Some plants mature early in the fall and start growth late in the spring, and so are less subject to frost damage. In addition, of course, there is the actual ability of the protoplasm within the plant cells to survive certain temperatures. This innate hardiness of the tissues of course depends upon heredity.

In a majority of plant breeding experiments, greater hardiness is one of the objectives. This may involve search in colder climates for types more resistant to cold to be crossed with tender varieties that have other desirable characteristics. Breeders have made great advances in increasing plant hardiness, although it is a difficult thing to check without a test winter, which may not occur for several years. There has been some progress in testing by artificial freezing, but in general the breeder simply waits and records the minimum temperature his seedlings will stand. He may plant outside, without protection, realizing that all may be killed, but hoping that an extra-hardy specimen will survive for further breeding.

Although potential hereditary hardiness cannot be altered by any method we know at present, yet the resistance to cold of an individual plant may be affected to a considerable degree by climate, current weather conditions and cultural methods.

A heavy frost in the middle of the summer would seriously damage or kill many plants which would withstand such a frost early in the spring or late in the fall. Plants have the faculty of maturing their tissues as summer conditions change to fall and early winter; an early fall frost will cause more damage than a late fall frost (just as an early spring frost will not cause as much damage as if the same minimum temperature were experienced later).

How Hardiness Fluctuates

There are many external and internal factors which affect this increasing hardiness as winter approaches. One of them is temperature itself, which apparently causes internal chemical and physical changes. Experiments have shown that after a few days of relatively warm weather during the winter, plant tissue will be more tender than after a few days of cooler weather. A cold snap closely following a warm spell will do a great deal more damage than if it follows a period of slowly dropping temperatures.

Plants are frequently injured but not completely killed by cold. This injury may hit certain organs much harder than others, and so far it seems difficult to do much generalizing. In some cases, for instance, flower buds may be damaged by cold, with no visible damage to other parts of the plant. In other cases the leaves may be damaged while flower buds are uninjured.

With many plants the base of the trunk is a particularly vulnerable place. Bark splitting is serious but not always fatal.

Fertilizers Influential

What to do about increasing hardiness? Most gardeners already know that heavy fall fertilization, with nitrogenous fertilizer, will cause soft growth which is more easily winter-injured. The oppo-

HOW TO PREVENT WINTER DAMAGE

Robert G. Mower

Condensed from *The Garden Journal*, published by The New York Botanical Garden, Bronx Park, New York

On Broad-leaved Evergreens

1. Use a permanent mulch to keep the moisture supply constant during the growing season and to prevent freezing and thawing of the soil in winter.
2. Make sure that the plants have an adequate supply of water before the ground freezes.
3. Plant specimens which are subject to burning in positions where wind and winter sun will affect them least.
4. Increase protection by using artificial shades and windbreaks, and/or by planting in a site that gets winter shade and good drainage.

On Deciduous Plants

These same precautions, if followed with deciduous plants such as magnolias and Japanese maple (*Acer palmatum*), will extend their usefulness into colder sections in which they could not otherwise be grown.

On Newly Planted Trees

Give plenty of moisture during the growing season, a good mulch in winter, and protection from the winter wind and sun. Sunscald or frost cracks can often be avoided by wrapping the trunk with burlap or other suitable covering. Difficult evergreens need a natural or artificial windbreak and sunshade.

On Plants Subject to Bud or Twig Injury in Severe Climates

A natural covering of snow is an ideal winter protection for low-growing evergreens and for deciduous plants subject to twig killing and flower-bud injury, since it prevents both drying winds and low temperatures from reaching the plants. The flower buds of forsythia and flowering quince survive where they are covered by snow. In regions where deciduous plants are killed back to the snowline every year, they should be planted, if possible, where natural drifts are likely to cover them. In areas where a covering of snow is often lacking, use artificial protective measures as suggested above.

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site extreme of underfeeding may also invite damage. Certainly on fertile soils, applying extra nitrogen during late summer or early fall may be undesirable. On the other hand, on very light, sandy soils if plants are showing signs of nitrogen deficiency, even in late summer, a small application to bring them up to normal may be desirable.

Learning About Hardiness

In the meanwhile we should be respectful of low temperatures and learn as much as we can about our particular plants, new and hardier varieties, environmental conditions in our gardens, proper nutrition, planting tender sorts in protected areas, and perhaps protection for special things.

It will be a boon to all gardeners when most woody plants have hardiness ratings which appear on the label at the nursery. Such ratings, combined with a hardiness zone map, and more knowledge of factors affecting hardiness should enable the gardener to view the approach of winter with a minimum of fear and worry.

TOUGHNESS IN PLANTS

E. Sam Hemming

Condensed from *American Nurseryman*, July 15, 1964

PLANT HARDINESS is a subject of many facets, yet in the main it refers to resistance to the vagaries of climatic extremes, particularly to cold. But there are other reasons for plant difficulties and failures, and it might be better to define a plant's resistance to these by such a term as *plant toughness.*

One would think, for instance, that since fertile soil is desirable for growing nursery stock, soil cannot be too fertile. I once knew of a nursery that had property where, for geological reasons, the topsoil was four to six feet deep. At first, the owner was delighted, because evergreens made the equivalent of two to three years' growth in one year. He was soon forced to stop using the ground because, when transplanted into ordinary soil around homes, the plants took two to three years to recover, and losses were higher than average.

During droughts, friends often ask why we do not put in general irrigation. There are more reasons than cost, for plants grown under general field cultivation in the East are tougher and have better root systems, and so, in turn, survive better for the customer. I have noticed, too, that large growers of container plants grow their plants now in full sun and generally on a black-top area. Here the plants form a full root system and strong, resistant foliage.

Not all plants, however, respond to "toughening." (This term is not the same as "hardening off.") Some plants respond only slowly, and others not at all. We have grown English boxwood for a long time and are familiar with its temperament. When we have opened up large old hedges and transplanted the plants, we have found that it may take as long as ten years before they are tough enough to survive on their own. Shade-loving rhododendrons in our area [eastern Maryland] never really become tough enough to survive.

We also run into difficulty with the American beech. As many as five years are required for a beech to be toughened enough so that it will withstand even a mild drought. By then, though, it will become almost indestructible. Regardless of care in transplanting, the tree often will die back to a certain extent, yet in the end will make a beautiful tree.

Cold hardiness has a toughness angle, too, *Magnolia grandiflora* being a good example in our section. We struggle to get this plant to 8-foot size; often it goes ahead two feet and back one foot. Yet around the county are big, old plants that go through even record cold winters without turning a leaf or showing any dieback.

Some flowering shrubs carry their toughness to extremes; they can go dormant in self-defense without dying and then resprout when the weather turns favorable again. This is true of temperate-zone shrubs, as well as desert plants. The crape-myrtle, for instance, can remain dormant a whole year and grow the following one. Even forsythia and *Hydrangea japonica* are quite sensitive to dry weather, but will wilt and recover with remarkable ease.

While toughness in a plant is desirable, it is not to be implied that it is the sole end or even a major goal. Rather, it is important to recognize it, both in production and in landscape use, to take fullest advantage of toughness when necessary and at other times to be alert to the lack of it in sensitive plants. This knowledge is just another part in the making of a well-rounded plantsman. ◆

GREENHOUSE GARDENING ON A TIME BUDGET

Seven steps to effortless success

Elvin McDonald

Reprinted from *Under Glass*, March-April 1964, published by Lord & Burnham Corporation, Irvington-on-Hudson, New York

(1) *Invest in all automatic equipment for ventilation, heating and cooling.* Use a mixing faucet for hot and cold water. Install a temperature alarm somewhere in your home where you or a member of your family is most likely to hear it at any hour of the day or night.

(2) *Install enough lights to provide plenty of illumination.* Then, when you want to, you can put in an hour or two in the greenhouse before going to work in the morning, or at night. This enables you to keep up and avoids saving everything for the weekend—when it may turn out that you cannot possibly be in the greenhouse for a sufficient amount of time to do the work necessary. I've learned that giving up an hour of sleep in the morning to work in the greenhouse sends me to my desk with new enthusiasm; and at the end of the day, there is nothing quite as relaxing as spending an hour in the greenhouse.

(3) *Limit your plant collection to a few kinds well grown.* The more you diversify, the greater will be the problems of culture, pests, and diseases.

(4) *Grow as many carefree perennial greenhouse plants as you can.* Annuals that require sowing and transplanting several times a year take a lion's share of time. On the other hand, some of the most colorful of all greenhouse plants are annuals—cinerarias, for example. Maybe you should grow ten dependable perennial plants and devote the time saved to two or three annuals that yield big dividends in floral display.

(5) *Use commercially prepared, pasteurized potting soil.* In the long run this saves much time and trouble. I obtain two-bushel bags of a well-known planter mix which gives good results for practically everything in my Sunlyt.

Many greenhouse gardeners are trying amaryllis a new way: The bulbs are kept in constant growth and flowers come from time to time without the bulbs being dried off and repotted each year.

Jackson & Perkins

(6) *Learn to decide what is most important and what can wait.* If, for example, plants need feeding and pest control, you'll be wise to take care of the pest control at once, tend to feeding the first chance later. And if you have time only for watering, but can't hope to get around to feeding or pest control for several days, you may be better off, for

'Laura Engelbert' is a new variety of angelwing begonia that blooms almost the year around.

Tropical Paradise Greenhouses

Philpott

Author McDonald with his sons at week-end chores

example, if you discard immediately a plant infested with mealybug; this requires almost no time, only a decision, but if you dash off and don't get back for several days, your pest problems may have multiplied until you *can't* throw out every infested plant. Another way to spot-check pest problems is to keep a houseplant aerosol on your supplies shelf. Aerosol spraying is not usually economical for an entire greenhouse, but it can save the day when there is no time for complete spraying or fumigation.

(7) *Develop a schedule of when to do what.* This planning is the answer to a well-ordered greenhouse filled with thriving, flowering plants. Keep a clipboard with paper and pencil on your potting bench so that planting notes and good ideas won't be lost. ◆

PHOTOPERIODISM AND ORCHID FLOWERING

Carl L. Withner

Condensed from the *American Orchid Society Bulletin*, July 1964; originally published in *Orchidata* of the Greater New York Orchid Society, Inc.

THE PRESENCE or absence of flowers on orchids involves light in several ways. First, there must be enough light to provide food for growth of bulbs and leaves and for reproduction. Most of us have had the experience of watching an orchid complete its seasonal growth, only to be disappointed by noning an orchid complete its seasonal appearance of a flower spike. This is mostly a matter of accumulating enough capital (food reserves) to accrue dividends (the flowers). But the more subtle effect of light on flowering involves the correct duration and combination of light and dark periods (photoperiodism). Fortunately, many orchids as well as other plants are relatively insensitive to the photoperiod. Such "insensitive" plants (day-neutral or day-length-indifferent plants, as they are called technically), so far as we are aware, bloom without any special combination of light and darkness. Some orchids, however, are extremely sensitive, and as a result we have "controllable" hybrids—plants that can be, so to speak, turned on and off as far as flowering is concerned. They may be kept from flowering altogether, usually by being given additional light in the evening or at night, or they may be made to flower at a given time by keeping them on a regimen of short days, with not more than 8 to 10 hours of light at a time.

In nature a wild plant will generally flower only at one period during the year—following the season when the proper light conditions prevail to trigger flowering. In cultivation, on the other hand, conditions may be manipulated to provide blooms when most desired. This kind of control for orchids has been worked out mostly for the so-called short-day (long-night) species such as *Cattleya labiata*, *C. percivaliana*, *C. trianae* and *C. mossiae*. Dr. Gavino Rotor has also found that *Phalaenopsis* species and *Dendrobium phalaenopsis* can be induced to form flower buds by short days. We know almost nothing about reverse examples, orchids that require long days (short nights) for flower bud initiation.

For the most part, long days seem to promote vegetative growth and inhibit flower bud production or development of buds once formed. In a few cases, exemplified so far by Rotor's work on *Paphiopedilum insigne* and *Dendrobium nobile*, temperatures are more important than daylength in initiating flower bud formation; but once flower buds are initiated in *D. nobile*, their further development is enhanced by long days.

In the fall and winter, "controllable" plants would ordinarily have only a short day and would be stimulated to flower production. With lights left on in the evening, artificial long days would be in effect and flowering would be delayed or even prevented altogether. This technique is particularly valuable when applied to *Cattleya labiata* hybrids in the fall. Flowers may thus be had for Christmas and New Year's, instead of October-November, when market demand is low. The manipulation of natural cycles means dollars and cents to the commercial grower. To the amateur with a home greenhouse, added light might inadvertently mean delayed flowering if he worked there every evening after coming home. All other conditions being optimal, this subtle effect of light might be explored if one's plants do not flower satisfactorily. ◆

ORCHIDS BEING PROPAGATED BY NEW METHOD

More plants can be produced at lower cost by culturing tissue from growing point

Mary Noble

Condensed from *The New York Times* of December 27, 1964

MERISTEM-tissue culture, a method for propagating orchids, has recently been developed. With this process, many thousands of plants with identical characteristics can be produced from a single clone within one year. Further, it is possible to reproduce triploids and other orchids that are sterile or difficult to breed.

Meristem is a new word to orchidists. Botanically, it is the growing point of a plant where the cells are dividing and have not yet differentiated into leaves, roots and stems. The meristem tissue is found in the apex of the growing point.

How Tissue is Handled

This portion of the plant is sectioned under a microscope and all work is done in sterile conditions. Tiny pieces of cell tissue are put into test tubes in an agar solution and kept under regulated light and temperature conditions. Within about a month, each tiny bit of tissue forms a small protocorm. This is removed from the tube and cut into about four pieces which are put into separate tubes. In another month the new protocorm can be cut. The continuous cutting keeps the cells from differentiating.

The number of protocorms differs from plant to plant. When enough divisions are secured, cutting ceases and each protocorm is allowed to grow into a plant. Within three to six months these little plantlets may be taken from flasks and potted into community or individual pots. From then on, culture is as for seedling orchids and, presumably, so is the time needed until they reach flowering size.

Benefits to Amateurs

What does this new dimension mean to orchidists? From even the most conservative point of view, it is admitted that meristem-tissue culture will revolutionize several aspects of orchid growing as we know it today.

To amateurs, it means that propagations of fine plants will be available at prices they can afford. While a mature division of a rare, prize-winning plant may list for $100 to $1,000 (if it is for sale at all), a meristem plantlet in a two-inch pot can cost less than $10 (current prices are about $8.50 for cattleyas and $6 to $30 for cymbidiums).

It is true, however, that the grower has to wait several years for the first flowers. But there will soon be meristem plantlets in larger sizes, flowering or nearly so, and the price will be considerably less because there may be hundreds or thousands of plantlets available.

Commercial Advantages

For the commercial cut flower producers, the new method means a sure crop of quality flowers when needed for holidays and weddings. Great quantities of plants with identical quality flowers will possibly be sold by name rather than as

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anonymous whites or purples. This, in turn, will upgrade the quality of cut flowers now on the market.

Development of Technique

Credit for developing the meristem propagation process in orchids goes to Dr. Georges M. Morel of the Institut National de la Recherche Agronomique at Versailles, France. Morel wrote about this technique in the *American Orchid Society Bulletin* in 1960. Dr. Donald E. Wimber of Brookhaven National Laboratory on Long Island reported in the same publication in 1963 on cymbidium research of this nature carried out under the auspices of the U.S. Atomic Energy Commission.

In the June 1964 bulletin Dr. Morel wrote about the quantity production of plants by clonal multiplication, and suddenly the significance of this technique burst upon the orchid world. Before working with orchids, Dr. Morel developed meristem culture processes for carnations (now used extensively by the Dutch), for dahlias and for producing virus-free potatoes.

Virus-free Orchids

Oddly enough, the process was not developed for the purpose of quantity production. The original research aimed to produce plants free of virus. For some reason not yet understood, plantlets propagated from the meristem tissue are free of virus even though the parent clone is infected.

A number of fine cymbidiums that are used in breeding and for flower production are infected with virus. Since a plant can never be cured of a virus, so far as we now know, the only hope for developing healthy plants from fine virus-infected clones is by meristem propagation. Assiduous care must be taken not to infect these plantlets by use of non-sterile cutting tools, carelessness or insect transmission.

Already on Market

The first meristem plantlets to be offered commercially are cattleyas and cymbidiums developed by the French firm of Vacherot and Lecoufle. The plantlets are six months to a year from the flasks, and several cattleyas and cymbidiums are available from the French nursery or from their two American representatives.

Research and Service

The American Orchid Society is sponsoring research on propagation of several other genera, plus studies on the elimination of virus disease.

Today, a number of orchid firms have their own laboratories and propagations in process, and even a few knowledgeable amateurs are trying the technique. It is possible for a home grower to send plants to laboratories offering meristem propagation service, but two things should be considered. First, the reliability of such a firm, as it seems likely that some unestablished persons may wish to capitalize on the process, and second, an honest appraisal of the plant in question. Is it really worth producing and growing several hundred divisions?

Questions Raised

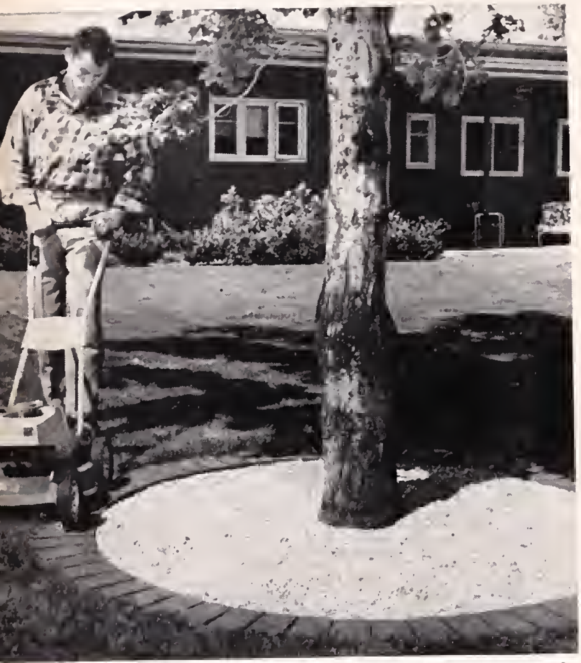
There is much controversy about several aspects of meristem culture, especially the effect of the process on hybridizing. Will nurseries continue to sell hybrid seedlings, or will they grow most of a promising cross to maturity, meristem the best and discard the rest? And what about the plantlets of today's finest hybrids? By the time these meristem divisions flower, will they still be top quality or will newer hybrids grown from seedlings be superior?

It is certain that this technique will call for changes in the awards systems of such organizations as the American Orchid Society and the Royal Horticultural Society. Also that clonal registration and patenting of orchids will be necessary. Orchid growers differ in their opinions of future developments with meristem culture, but all agree that changes are ahead and that we must revise our thinking and adapt our habits to keep pace with the future. ✦

BETTER GARDEN GROOMING

Tips conceived for ease of maintenance

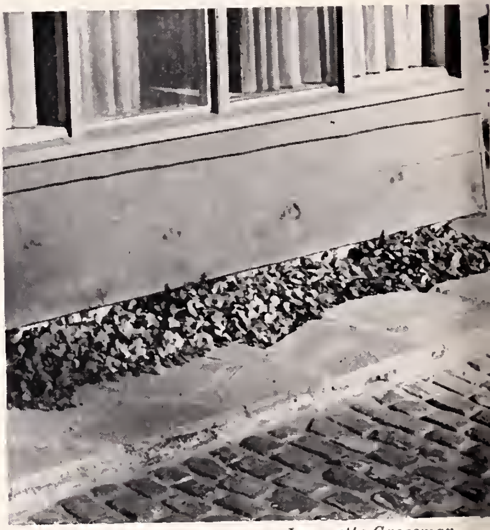
Condensed from *Popular Gardening/Outdoor Living*, January 1964



Jacobsen Manufacturing Co.

Neatness around a tree may be achieved with crushed stone and a brick edging. (NOTE: If there are small children in the family, substitute a low ground cover for the stone.)

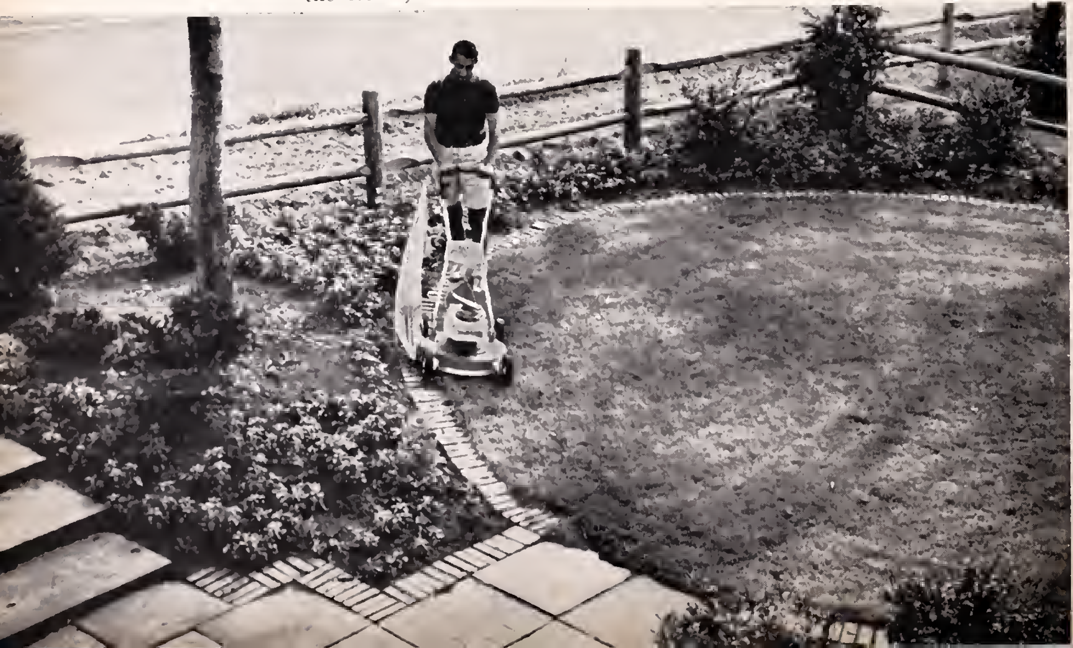
Where rain would splash both house and path with soil, planting a ground cover close to the foundation helps to keep these surfaces clean.



Jeannette Grossman

A circular edge to a plot of grass is easier to mow than a rectangular one; there are no corners to maneuver.

Jacobsen Manufacturing Co.



BIOLOGICAL CONTROL—PROBLEMS AND PROSPECTS

Discoveries and investigations point to further progress in using Bacillus thuringiensis against insect pests

Charles C. Doane

Condensed from *Frontiers of Plant Science*, May 1964, published by the Connecticut Agricultural Experiment Station, New Haven, Connecticut

IN THE ANNALS of plant protection, the chapters on non-chemical insecticides warrant careful study. One of these chapters—still clearly incomplete—deals with *Bacillus thuringiensis*, a bacterium long known for its ability to kill certain insects, particularly lepidopterous larvae.

For several years we have been interested in this bacterium as a possible control for some of our defoliating caterpillars. Low toxicity to wildlife makes it particularly useful against pests of woodlands and shade trees where problems with insecticides may arise. People living in wooded areas are well aware of the damage done by heavy infestations of defoliating caterpillars feeding uncontrolled.

In 1963 Dr. Stephen W. Hitchcock and I tested an experimental liquid suspension of *B. thuringiensis* against cankerworms and the gypsy moth. The results of our experiments were somewhat erratic and suggest that further experimental work is needed before large-scale control of gypsy moth and other defoliating caterpillars with this bacterium is feasible.

Half a Century of Trial

The history of *B. thuringiensis* shows that Berliner first isolated the bacterium from diseased larvae of the Mediterranean flour moth about 50 years ago. In the years that followed his publication periodic attempts to use this organism for insect control met little success. Then the successful use of *B. thuringiensis* on alfalfa caterpillars by Steinhaus of California revived interest in its possibilities.

The most important advance, however, was a rediscovery by Hannay in 1953 of the crystal which Berliner had described in 1915.

Originally it was supposed that after ingestion the spores of this bacterium multiply rapidly in the gut and eventually break through into the body cavity. We now know that the sequence of events is much more complicated.

As each vegetative cell sporulates, a resistant spore is formed at one end of the cell, and a diamond-shaped crystal is formed at the other. These two bodies are then released by the disruption of the old cell wall. The rediscovery of the crystal, and the more important observation that these crystals might be connected with the pathogenicity of *Bacillus thuringiensis*, brought rapid advances in research. Since 1953 it has been found that *B. thuringiensis* produces at least four other toxins as well as the toxic crystal. Most attention has been given the toxic crystal.

The reaction of lepidopterous larvae can be grouped into three types according to their response to the crystal toxin. In the first type, the gut of the larva becomes paralyzed after ingestion of the toxin and total paralysis follows in 1 to 7 hours. The silkworm and the tomato hornworm are representatives of this type.

(*Concluded on page* 31)

WAR ON INSECT FELONS

Observations of the The Plant Doctor

Cynthia Westcott

Condensed from *American Forests,* February 1964

THE PROTECTION of trees from diseases and insects is an integral part of conservation. Such protection includes, but is by no means limited to, the use of chemicals. For more than 25 years, operating as "The Plant Doctor," I was exposed to garden chemicals, all day, every day, from March to November. I am still alive to tell the tale and I have no record of ever having harmed a pet, bird, child or client.

This is not to say that pesticides are not dangerous. They are definitely poisons to be used with the utmost caution, and there have been tragic results from thoughtless and careless use. But if they are chosen with common sense, applied according to directions, with proper disposals of left-over spray and containers they can be used safely.

The chemicals that have been causing so much controversy are actually in use for a very small fraction of our total number of insect pests and plant diseases. I have just gone through the check lists in *The Gardener's Bug Book* and the *Plant Disease Handbook* and have counted the pests, important enough for specific description, listed under certain hosts. Here are a few samples:

Host Plant	*No. of Insects*	*No. of Diseases*	*Total Pests*
Apple	171	124	295
Ash	52	31	83
Elm	96	57	153
Fir	38	59	97
Hickory	50	38	88
Linden	41	37	78
Locust	37	33	70
Maple	95	82	177
Oak	124	71	195
Pine	140	105	245
Rose	126	83	209
Spruce	65	39	104

Note the appalling number of possible pests on apple—and yet the farmer probably organizes his spray schedule chiefly for apple scab and codling moth, with the other pests taken care of incidentally. When I sprayed roses, I did not worry about those 209 possibilities; I timed sprays to control blackspot, mildew and half a dozen insects. Timing was important.

In the fall I visited two public rose gardens that I had helped start. One had been sprayed regularly all summer by my former assistant; there was not a single lesion of blackspot, no sign of insect injury, no visible spray residue; plants were in full bloom and foliage was down to the ground. A couple of miles away were the roses under care of a park commission. They had evidently been sprayed when workers could be spared from other occupations. There was nearly a 100 per cent black spot; almost complete defoliation. I expect many of those roses will die next winter and the weather will be blamed.

So it is with forest spraying. It is not often necessary but when an emergency arises with threat of defoliation, prompt action is vital. An evergreen completely defoliated may die in one season; it may take two or three years for a deciduous tree to die from defoliation. Any legislation which allows for protracted argument and delay before spraying will defeat its purpose.

There is, of course, legitimate concern for wildlife in relation to use of chemicals but one must consider the effect of refraining from chemicals as well as the possible harm from their use.

Dr. Kenneth Graham, Professor of Forest Entomology at the University of British Columbia, in his book *Concepts of Forest Entomology,* 1963, states:

> The over-all effects of sprays on birds do not appear to be as serious as the effects of exposure in an insect-defoliated forest. Without protection of a forest from defoliation by insects, almost total loss of nesting birds may follow their increased exposure to heat and predators.

And, of course, trees killed by insects greatly increase the chance of birds being victims of forest fires.

Despite its benefactions, DDT has been singled out as the chief villain in the adverse publicity about pesticides. It is, however, far safer than the nicotine and lead arsenate we used before modern chemicals came along. A 150-pound man is likely to die after ingesting only 1/5 to 1/2 teaspoon of undiluted nicotine, or ½ to 1½ teaspoons of lead arsenate, whereas it takes from three to nine teaspoons of DDT for a lethal dose.

The amount of DDT, one-half to one pound per acre, used to control forest insects, is much less than that used in the dormant spray applied to elms for control of bark beetles spreading Dutch elm disease. In such cases there has been some mortality of robins, particularly in the Midwest. Apparently this comes from eating earthworms which have concentrated the DDT in their bodies. The individual community must decide whether to try to save trees which cannot be replaced for generations or to sacrifice the trees for the birds, which usually can be replaced in a year or two. In a few eastern communities, spraying has saved the elms with no noticeable effect on birds. ◆

BACILLUS THURINGIENSIS

(*Continued from page* 29)

The greatest number of species belong to the second type. Only the gut becomes paralyzed; the insect ceases feeding, wanders about, and usually dies in 2 to 4 days.

Finally, the response of the third type of larvae to *B. thuringiensis* is the most complicated. Investigation of this type led to the discovery of a soluble toxic material present in the growth medium. The combination of this toxin together with the spores and crystals is necessary to produce high mortality to the Mediterranean flour moth. The spores or toxic crystals used alone cause only slight mortality in this third type of larvae.

The crystal toxin is alkali-soluble. To be effective it must be dissolved in the gut of the larva. Thus only those larvae with a suitably high alkaline gut content are susceptible to the crystal of *B. thuringiensis.* Resistance in certain species may be explained: the gut contents are not alkaline enough to break down the crystal.

Bacillus thuringiensis is applied more like an insecticide than are some biological control agents since it does not maintain itself in nature by causing continuous reinfection. In contrast, *Bacillus popilliae*, the milky spore disease organism in larvae of the Japanese beetle, remains effective in the soil for many years. The effective life of *B. thuringiensis* is about one week. Repeated applications are therefore necessary.

Since the discovery of the crystals, upwards of 40 separate strains of crystal-forming bacteria have been isolated from various parts of the world. Most of these differ widely in their pathogenicity to insects. At present only one strain of *B. thuringiensis* is being produced commercially for insect control.*

A drawback in the use of *B. thuringiensis* is the rather large amount of the material needed to kill certain insects. One recent line of investigation is a search for additives that might enhance or increase the effect of the bacterium or, conversely, make the insect more susceptible to the spores and crystals. ◆

***Bacillus thuringiensis* can be obtained from the Los Angeles Chemical Company, 4545 Ardine Street, South Gate, California; the Grain Processing Corporation, Muscatine, Iowa; Nutrilite Products, Inc., P.O. Box 98, Lakeview, California; and, as Thuricide, from the Stauffer Chemical Company, 380 Madison Avenue, New York, N. Y., 10017. These sources generally supply dealers only.—Ed.

Aphids on a leaf of tobacco. Infestations like this may eventually be controlled by surrounding the plants with shiny material such as aluminum.

ALUMINUM TO REPEL APHIDS

James B. Kring

Condensed from *Frontiers of Plant Science*, November 1964, published by the Connecticut Agricultural Experiment Station, New Haven, Connecticut

APHIDS spread from plant to plant primarily by flying. In so doing they may spread virus diseases. Damage to plants, either by their feeding or by a transmitted virus, may be severe.

Infestation of crop plants and spread of aphid-borne virus diseases could be stopped if aphid spread could be prevented.

Trapping Technique

Many investigators use shallow cake pans painted yellow and filled with water as traps to capture aphids. The aphids are attracted by the yellow color and alight on the water surface. A small amount of detergent in the water changes the surface tension and traps these insects, preventing them from taking off again.

When winged aphids first take off from their host plant, they fly toward the open sky. When they are ready to alight, they fly away from the open sky. At this stage of their flight they are reported to be actually repelled by the light from the sky. If this be true, an alighting aphid presented with two "skies" might be confused and so not alight on plants where protection is desired.

Aluminum as a Repellent

Aluminum placed on the soil reflects much of the light from the sky and so presents the aphid with two skies. Aphids do not alight in the yellow colored cake pans when they are closely surrounded by aluminum cake pans. The efficiency of this method of repelling aphids depends on how much of the surrounding area is covered by aluminum. By moving the aluminum pans farther away from the trap or using fewer pans, the trap again catches aphids. Substituting aluminum-surfaced sheets for the unpainted pans has the same effect. Yellow traps surrounded by bare soil catch more aphids than the same traps surrounded by aluminum.

Since the aluminum surfaces can also

IN Connecticut, the author's home state, there are more than 200 different kinds of aphids, small sucking insects that feed on plants. Many of them overwinter as eggs on the bark and branches of trees and bushes. The individuals that hatch from these eggs in April and May begin to feed and reproduce. All are females, and they give birth to living young. When these young are born their own female offspring are already partly developed. Under favorable conditions of dry, warm weather, these newly born aphids may produce young in as short a period as three days. Some are winged, and these fly to other plants to start new colonies. In the fall males and females develop, meet on the winter host, and produce the overwintering eggs from which more aphids will hatch in spring.

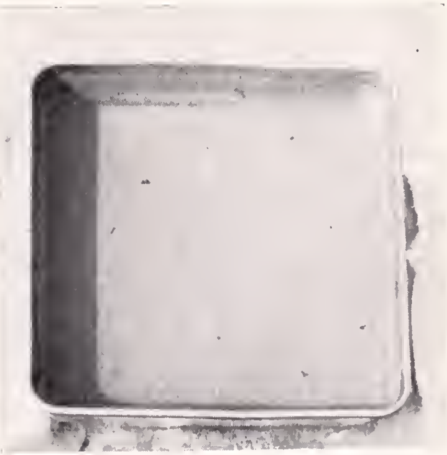
reflect heat which may be undesirable for some plants, I looked for another way to change the background. I had found that yellow pan traps placed among plots of cabbages and nasturtiums caught somewhat similar numbers of aphids until the nasturtiums began to bloom. Then fewer aphids were captured among the nasturtiums. This suggested that the orange color of the nasturtium flowers repelled the aphids.

To simulate the effect of the color of the flowers, the trap pan was placed on a background of orange-colored plastic. Shiny black plastic commonly used for mulching was compared to the orange-colored plastic and to the aluminum coated materials. I found that all of these backgrounds drastically reduced the numbers of aphids captured by the traps. The aluminum was most effective, followed closely by the orange and the shiny black plastic.

Practical Uses Being Tested

As one might expect, I then found that plants surrounded by aluminum, by orange-colored plastic, and to a lesser extent by shining black plastic were protected from attack by aphids. These results suggest many practical applications. Researchers in the U. S. Department of Agriculture and elsewhere are now testing this method further. ◆

Aphids attracted. Yellow-painted pan containing water and detergent traps aphids for investigators.



Aphids repelled. A plain aluminum pan causes aphids to leave an area. Subsequent to this discovery it has been shown that sheets of aluminum placed around plants will protect them from aphid attack.

SALT INJURY TO ROADSIDE TREES

Avery E. Rich and Norman L. Lacasse

CONSIDERABLE controversy has developed regarding the injury to roadside trees from applications of salt to highways in winter. There has been much speculation on the subject but very little factual evidence.

In a 1957 survey of roadside trees the State Highway Department of New Hampshire found 13,997 dead trees along 3,700 miles of highway. The problem appeared to us to be worthy of a careful study.

Observations

Roadside maples have been declining at a rapid rate in recent years. Symptoms include: leaf scorch, curled and stunted leaves, premature fall coloring, dead and dying branches in the crown, accompanied or followed by a gradual decline in vigor, resulting in ultimate death of the tree. Maples appear to be affected more than other deciduous trees. Among the coniferous species, hemlock appears to be the most sensitive, followed by white pine. Maple decline is most pronounced on trees close to the road. It is usually most severe where roads have been widened and hardsurfaced, and where the pitch or slope of the road is such that the drainage pattern is from the road surface to the tree root zone.

Methods

Five hundred fifty maples were sampled along U.S. Highway 4 in Northwood, New Hampshire. The data were transferred to punch cards and processed at the U.N.H. Computation Center on a 1620 IBM Computer. There was a highly significant (99:1) inverse relationship between distance from the road and salt injury symptoms. Symptom expression differed significantly (19:1) with distance and elevation within 30 feet of the road.

The amount of salt in the leaves and twigs was determined by measuring the amount of sodium present with a flame photometer. Twig and leaf samples from 150 trees were measured in this manner. The results showed that leaves and twigs from trees near the edge of the road (within 30 feet) contained more sodium than trees back away from the highway.

Samples of maple sap were collected from 80 sugar maple trees in March 1962, and they were analyzed for soluble salts. Some of the samples from trees near the highway had a relatively high salt content.

Experiment

In an attempt to measure the tolerance, uptake and translocation of salt by trees, seedlings of sugar maple (*Acer saccharum*), white birch (*Betula papyrifera*), tulip-tree (*Liriodendron tulipifera*) and white ash (*Fraxinus americana*) were grown in vermiculite and treated with 5 different concentrations of salt. The white birch and white ash seedlings proved to be salt tolerant and they did not translocate sodium to the leaves. The maple seedlings were sensitive to the lowest concentration of the salt (250 parts per million), and the sodium was translocated readily to the leaves. The tulip tree seedlings were intermediate in their sensitivity to salt injury.

The results of these experiments indicate clearly that salt plays an important role in maple decline. Most of the injury occurs to trees within 30 feet of the edge of the pavement. This approximates the area of the plowed windrow of snow.

The exact nature or mechanism of injury has not been determined by this study, but probably it is a form of "physiological drought." Salt interferes with the normal process of osmosis. It may also be toxic to the root system, thereby reducing its efficiency.

Roadside soils are usually very low in fertility. Sodium may be replacing more important elements such as potassium, thus causing a nutritional imbalance.

Recommendation

It is not claimed here that the use of salt should be discontinued on the highways. Highway safety and human life are of prime importance. Instead, it is recommended that if new trees are planted along old highways, they should be set back at least 30 feet, and some thought should be given to the drainage pattern. When new highways are built, drainage ditches should be constructed between the edge of the road and the trees to carry off the excess salts. ✦

Condensed from *Connecticut Woodlands*, November-December 1964, published by the Connecticut Forest and Park Association, Inc., 15 Lewis Street, Hartford, Connecticut; originally published in *Forest Notes*, Winter 1963-64, issued by the Society for the Protection of New Hampshire Forests, 5 South State Street, Concord, New Hampshire

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AIR POLLUTION INJURY TO WHITE PINE

Atmospheric constituents not yet identified

Charles R. Berry and George H. Hepting

Condensed from *Forest Science*, March 1964

DURING the late 1950's, the Forest Service was called upon to look into a general decline of eastern white pine (*Pinus strobus*) over an area of several hundred square miles in the Cumberland Plateau of Tennessee, mostly in Morgan County. Symptoms of the trouble included, in part: premature shedding of older needles; discoloration of current year's needles at any time of year; gradual reduction in shoot and wood growth, and early death of trees. There was striking tree-to-tree variation, with some trees dead or dying and others unaffected in the same stand.

Initial investigations indicated that none of the known diseases or insects attacking white pine was responsible for the damage. This trouble has been called post-emergence chronic tipburn (PECT) and air pollution should be considered as a possible casual agent. In or near the Tennessee area affected by PECT there are several large industrial installations, including TVA's Kingston steam plant, AEC's Oak Ridge facility, a pulp mill at Harriman, and a ferroalloy reduction plant and an iron smelter in or near Rockwood. The disease was also found in other industrial areas, including some which contained coal-burning power plants.

Root and stem isolations yielded no primary pathogens. Pruning and fertilizing sometimes brought about improved vigor, but did not affect occurrence of needle tipburn, a primary symptom. Diseased trees transplanted out of the affected area recovered, while trees transplanted within the affected area continued to decline.

Scions from susceptible trees displayed symptoms year after year even when grafted to resistant trees in the affected area. Scions from resistant trees continued to be disease-free year after year even when grafted to diseased trees. The grafting experiment furnished evidence that a virus was not involved and indicated that the cause of the trouble was an atmospheric agent.

Members of susceptible clonal lines potted with the same soil mixture were injured when placed in the affected area, while others remained disease-free outside. This use of susceptible clones as biological indicators gave further evidence that the disease causal agent is atmospheric and that the level of resistance is genetically controlled. ✦

PLANTING TREES AND SHRUBS AROUND GRAVEL PITS

T. U. Hartwright

Condensed from a 72-page paper-bound book issued by the Sand and Gravel Association of Great Britain, 48 Park Street, London, W.1, England

IT CAN never be said that a gravel pit is a thing of beauty, but much can be done to soften the effect on the senses by screen planting. Often a single row of fast-growing trees along a road frontage will make all the difference.

Advantage of Early Planting

The importance of planting trees at the earliest opportunity is obvious. If an operator holds land as a reserve for future digging, he should plant a screen as soon as the land comes into his possession, particularly around the proposed working area. By the time a planning application is submitted, the trees will be firmly established and the local planning authority will have difficulty in arguing that the pit should be located elsewhere. Trees actually growing will sway opinion more than promises. Apart from visual consideration, tree screens have a marked effect on the reduction of noise if located between the noise source and adjoining properties.

Developing a Plan

In planning the over-all effect, it must be remembered that one is dealing with large areas; accordingly, bold planting is called for. It is useless to attempt to eke out the trees available by planting them singly at intervals around the pit. Trees and shrubs in groups look more natural and will attract the eye.

The next factor to consider is which part of the pit is to be seen by the public from adjoining houses, roads, footpaths and railways. These are the areas which must receive priority.

Even more can be done to improve the appearance of a gravel pit by planting an avenue of trees on either side of the entrance roadway. The areas under the trees should be leveled and grassed over. Herbaceous borders should be kept to a minimum to cut down the cost of upkeep.

When planting shrubbery it is most important to leave room between plants so they will have space to grow. Shrub plantings are often spoiled by overcrowding. When this happens the more vigorous varieties outgrow and overwhelm the others.

Preparing to Plant

Before planting can take place the site must be prepared and tidied up. During the process of excavation thought must be given to the eventual shape of the lake that may ultimately be formed, as this is something which cannot be determined in advance. A sudden fault in the gravel stratum may provide an opportunity for an island or a point running out into the lake. Overburden [waste] may be cast in heaps along the edge and at a later stage be leveled off with a bulldozer so that an irregular margin will result. Every effort should be made to avoid featureless straight lines.

It is most important that all margins be evenly graded and leveled before planting. Similarly all heaps and mounds of waste left round the pit should be leveled. Ideally the areas which have been so treated should be sown to grass and cut twice a year to prevent seeds of noxious weeds spreading onto adjoining properties. [Cutting with a rotary mower, set high, is an inexpensive operation.] But unless the ground has been leveled in the first place, cutting by mechanical means is not feasible. This treatment can be scheduled so that the

(*Concluded on page* 53)

Tulip field in the heart of Holland's bulb district

THE GIGANTIC BULB TRADE OF THE NETHERLANDS

Exports valued at nearly $90 million in 1964*

Harold L. Norton

Condensed from *Foreign Agriculture*, May 4, 1964, published by the U. S. Department of Agriculture, Washington, D. C.

FOR ABOUT eight weeks of every spring, hundreds of millions of tulips, hyacinths, and narcissus set Holland's famous bulb district aflame with a brilliant carpet of rich colors. These magnificent blooms, unmatched for their variety and beauty, tell the story of centuries of hard work, science and enterprise, which have brought fame to the Dutch bulb industry and made it one of the country's major dollar-earners.

Growth of the Industry

Just when the first tulip bulb reached Western Europe has not been established, but records show that the flower was being grown in Holland in 1571 and in England by 1582. Similarly, daffodils and other narcissi, native to Central and Southern Europe, received the attention of Dutch growers.

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*Figures marked with an asterisk (*) have been brought up to date by the author for this condensation of his article.

The Dutch soon established a flourishing business in bulbs. By 1637, tulips had become the object of an extraordinary speculation, in which prices for single bulbs rose to fantastic levels. When the bulb market crashed, thousands of persons were left bankrupt, and the Dutch Government was forced to prohibit the public buying and selling of bulbs for years thereafter. Growers fell back to truck farming, but continued to grow bulbs as a hobby.

By 1860, commercial bulb production had expanded to about 750 acres. Today, (as represented by 1963) approximately 26,600 acres* are planted to bulbs: about 11,900 acres * to tulips, 2,900 acres * to narcissi, 1,900 acres * to hyacinths, and about 9,900 acres * to various other bulbs.

The present acreage in the Netherlands is divided among 10,000 growers. Some of these, carrying on family traditions which go back several centuries, have large-scale production plots as exclusive agricultural enterprises. Others have comparatively small commercial lots, and many grow bulbs as a side line. A large number concentrate on growing bulbs to be sold at the main and traditional bulb exchanges at Haarlem and Hillegom, where millions of bulbs are bought by exporters and bulb dealers. There are about 600 firms now exporting, which includes many who export as a side line. In addition, there are regular bulb auctions at Lisse, in the heart of the bulb district, and Bovenkarspel in North Holland.

Developing New Varieties

Part of the total bulb area is devoted to plant breeding, research, and similar work. Here the great skill of the Dutch growers is best shown in the production of new varieties. It takes about seven patient years to produce from seed a bulb ready to flower, and several more years before it is ready for marketing; and when growers depend on bulblets (the main method of production) which grow every year from the parent bulb, it takes from one to four years for these progenies to become sufficiently large to be marketed.

Of the new seeds developed by plant breeding and hybridization scarcely one out of every 5,000 is worth keeping, and of those that are kept, barely one in 100 turns out to be a new and attractive variety. If it is really new and satisfactory, it will take ten more years to produce a few hundred of the new bulb and still more years to increase the stock to a quantity for marketing on a commercial scale.

The current list of main varieties of spring flowering bulbs commercially traded comprises about 600 tulips, 150 daffodils and other narcissi, 65 hyacinths, 50 crocuses and numerous miscellaneous bulbs, such an anemone,

Hyacinth flowers being stripped by hand from their stalks before the bulbs are harvested.

Bulbs in one of the large auction halls at Lisse being inspected by prospective buyers in advance of bidding.

ranunculus, muscari, and scilla. There are, however, many more varieties and kinds produced in smaller volume. Some of these have histories dating back 200 years or more, while others are of recent vintage, as Holland's breeders constantly add new varieties to the ever-growing list of flower bulb offerings.

Four Billion Bulbs a Year

Bulb production in Holland—which began with a few exotic curiosities—has developed into an annual total of about 4 billion bulbs. From the start of mass production efforts 50 years ago, growers have raised bulb output from about 12 million kilograms in 1900 to the 80-million kilogram level [80,000 metric tons, or nearly 90,000 short tons] in 1962.

The popularity of bulbs can be attributed to the effective Dutch salesmanship which boosted exports between 1900 and 1932 from about 8,000 metric tons to 23,500 metric tons. After the war, the industry carefully organized and planned a program to increase production and retrieve export markets. From the 1947 crop about 30,000 metric tons of bulbs were exported, which was a remarkable feat in view of the difficult conditions that existed. Since then the industry has increased its trade steadily until 1964 when the Dutch shipped more than 75,000 metric tons * of bulbs, valued at nearly $90 million. *

Buyers were found in 125 countries and territories of the world, but Western Germany, the United Kingdom, the United States, and Sweden absorbed nearly two-thirds of the total exported, while an appreciable part of the remaining one-third went to France, Canada, Italy, Belgium, Switzerland, and the Scandinavian countries.

Regulation of Bulb Marketing

The Dutch bulb industry is highly controlled. The primary organ which establishes policy and enforces rules and regulations under the supervision of the Ministry of Agriculture, is the Marketing Board for Ornamental Horticultural Products. The Board represents every segment of the industry (growers, exporters, laborers, etc.) and is, in fact, responsible for the administering and financing of the system.

Under the Industrial Organization Act of 1954, the Board regulates the production of bulbs by fixing annually the area which may be planted with the main kinds of flower bulbs (tulips, hyacinths and narcissi) for every grower. Further, the Board establishes minimum prices for the various bulbs, to assure the grower a definite return for his production.

The grower can sell excess bulbs to the Surplus Fund in order to receive some return from his labor and reduce his losses in a difficult year. The Surplus Fund is financed by a levy on all bulb growers in proportion to the size of their production. Thus, the bulb industry has succeeded in achieving a measure of security for the grower without the expenditure of public funds. Since 90 to 95 per cent of the bulbs are for export, it was found necessary to establish minimum export prices to provide a reasonable "floor" price and to give foreign buyers an assurance of price stability, from which both growers and buyers have gained.

This organized effort has led to more effective marketing, to a system of thorough inspection of fields and crops to combat diseases and pests, and to improvement of the quality of bulbs. It has also provided the basis for cooperation of the whole Dutch bulb industry to promote the sale of flower bulbs throughout the world. ◆

FLOWERS FOR THE PICKING

Lois Woodward Paul

Reprinted from the *Bulletin* of the Garden Club of America, March 1964

WE HAVE BEEN remodeling a small, old house in Chester County [Pennsylvania], and have been without a garden for the first time since the war years. To my great delight, I have been able to have lovely flower arrangements which have given us all pleasure.

During the month of July, the roadsides were bountiful with Queen Anne's lace, bouncing-Bet, red clover and Japanese honeysuckle. In a simple container, filled with Oasis, I found these flowers with their short stems a joy to arrange. I marveled at their sturdiness compared with the cultivated flowers I had become accustomed to using.

Saponaria officinalis, commonly called bouncing-Bet or soapwort, was a star performer. The soft pink or white, double or single flowers have a sweet spicy perfume characteristic of some of the other genera of *Caryophyllaceae*, the Pink Family.

I discovered that if I took the time to pick only the new freshly opened blooms, my flowers were attractive for a week, with only water added as needed. We are, indeed, fortunate to be in an area where the roadsides are not sprayed.

When August arrived, I changed my color scheme to chartreuse and yellow in the form of goldenrod and sunflowers lightened by a delicated touch of white which the daisy fleabane (*Erigeron*) contributes. No doubt, with a little effort, we could find materials of interest for each month of the year. ◆

POTSMANSHIP

An English gardener's view

Roy Elliott

Condensed from *Gardeners Chronicle*, May 23, 1964

BETWEEN the old-established porous clay pot, which is breakable, variable, and always requiring scrubbing* and the plastic newcomer, which is clean and almost unbreakable, the choice would seem an easy one. But it is not.

With the clay pot, the porosity which makes it so hard to clean and so subject to frost damage is its greatest virtue, bringing aeration to the roots of the potted plant. One hesitates to be dogmatic, but one fact at least emerges from practical, personal experience. One cannot use both types of pot for the same use at the same time.

I have made occasional use of plastic pots for many years, but have now reverted to my old enemies—clay pots. Plants often dry out too quickly in clay pots, but they do not dry out quickly enough in plastic pots. Too much water is retained for too long in plastic pots, and in winter they are very difficult to water properly. As far as I am concerned I lose many plants from over-watering, but few from under-watering. A plant which is too wet in winter in a plastic pot will die; a plant too dry in a clay pot in summer will generally give warning of its sorry state by flagging leaves and the familiar "hollow" note when tapped. (For all our modern instruments, the "tap" of the experienced gardener is still the best indication of whether a clay pot needs water.)

I first started to use small (2½-in.) plastic pots for seed-raising; I ran out of plastic pots, and mixed clay and plastic indiscriminately in the seed frame. I lost nearly all the seedlings in plastic pots through over-watering, and and most of the others for the opposite reason.

The next year I used plastic pots exclusively, with a John Innes seed compost. Success was reasonable, but the soil was almost always too wet, and moss formed very quickly on the surface. I seldom had to water the pots, and was hopeful that success would eventually come from experience. So next year I used 20 per cent drainage of ¼-in. granite chips in the bottom of each plastic pot. I mixed 50 per cent of ¼-in. granite chippings with the J.I. seed compost, and top-dressed with sieved coal chips. Germination has been remarkable, and so far moss has been negligible. I am now a confirmed believer in plastic pots for seed-raising, provided allowance is made for drainage to a degree quite unnecessary in clay pots.** Furthermore, when I want to pot up the young seedlings, I merely allow the plastic pot (almost) to dry out. When tapped out onto the potting-shed bench, the potting soil—with its 50 per cent chippings—then disintegrates, and allows the seedling to be lifted free of soil.

Another aspect of potsmanship concerns propagation. Most amateur gardeners who raise plants from cuttings rely

(*Concluded on page 45*)

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*A recently developed product called Algicide, which keeps flower pots free of green algae for about six months, makes much of the scrubbing of pots unnecessary. Described in PLANTS & GARDENS for Summer 1963 (Greenhouse Handbook for the Amateur); available from Nu-Tone Products, 1515 Platte Street, Colorado.—ED.

**Experience at the Brooklyn Botanic Garden with growing bonsai in ceramic containers without drainage holes confirms the author's experience with seedlings and proves that adequate drainage within the growing medium and restrained watering makes it possible to carry mature plants over indefinite periods.—ED.

The Tudor garden, which includes cloisters as in an old monastery

ROOF GARDEN IN LONDON

Denis Hardwicke

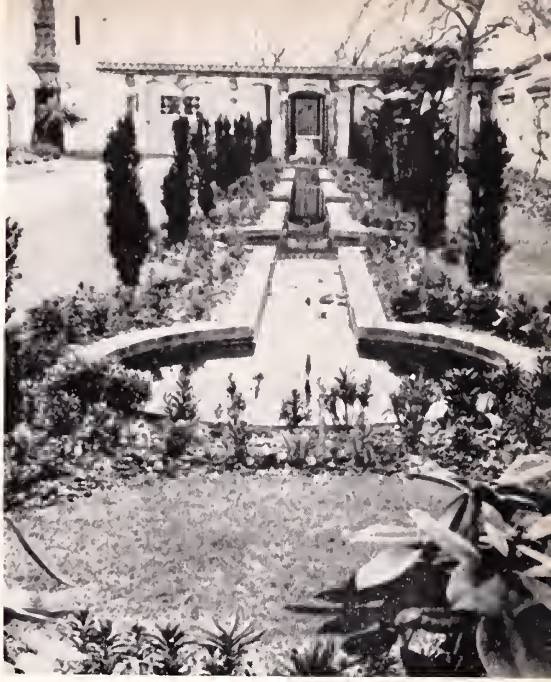
Condensed from the *Gardeners Chronicle*, April 25, 1964

VISITORS to the roof garden of the London department store of Derry & Toms will find a garden oasis covering nearly two acres 100 feet above the street.

There is a Spanish garden with a fountain court and Moorish pergola. A separate garden is designed in Tudor style. In a third, an English woodland garden, bluebells give a natural touch and, beside a stream, hardy ferns grow happily beneath silver birches and flowering cherries.

Footbridge over stream in English woodland garden

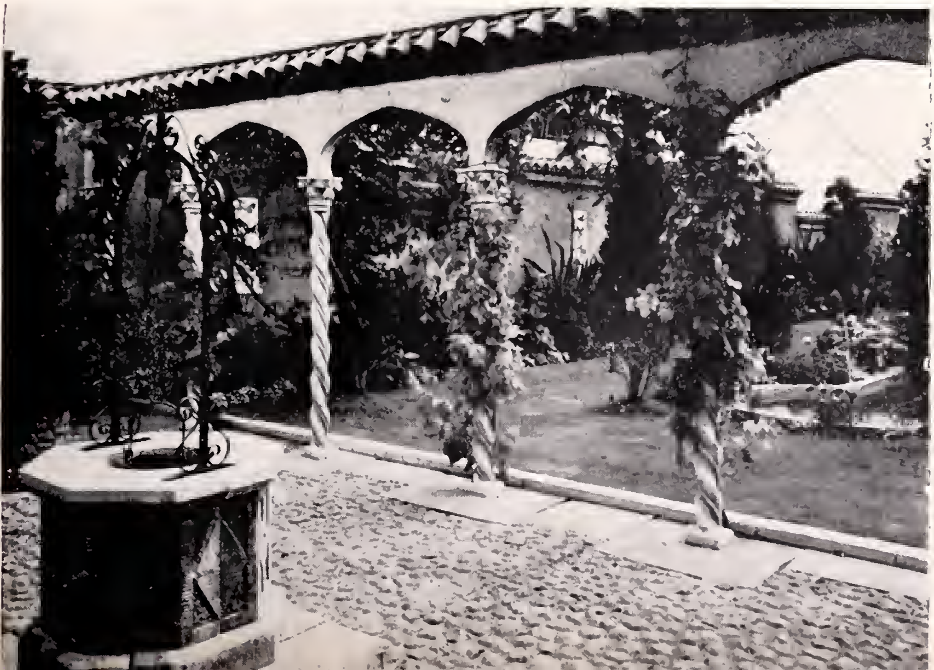
EVERY American visiting London should go to Derry & Toms' Department Store, where there is a remarkable garden. Unless I had visited it, I would find it difficult to believe that such a perfect roof garden existed. Conceived with inspiration, executed with artistry, and maintained with skill, this is one of the wonders of horticultural England.—T. H. EVERETT


Court of fountains in the Spanish garden

The roof garden contains a remarkable variety of trees and shrubs, hardy perennials and climbing plants, including clematis and roses, figs and walnuts, many apple varieties, lilacs, hydrangeas and magnolias. Well-mown lawns are another feature. Thousands of bulbs make a grand display in spring. Throughout the summer, color is provided by bedding plants. These are all raised on the roof in a compact nursery with an electrically heated greenhouse, frames, and all that is required in a propagating department.

The man in charge of the plants and plantings since 1941 is John Herbert Tarvin. The gardens were designed by the late Ralph Handcock and opened to the public in 1938.

Alcove in the Spanish garden, with Moorish pergola and an Italian-made well



PROPOSED SCENIC HIGHWAYS THREATEN WILD AREAS

Shawangunk Mountains of Ulster County, State of New York, face an introduction to the Motor Age

Brooks Atkinson

Copyright 1964 by The New York Times Company; reprinted by permission from Mr. Atkinson's column "Critic at Large" in *The New York Times* of June 8, 1964

SINCE THE Shawangunk Mountains in Ulster County already compose an ideal wild area, it is difficult to see how they can be improved.

But Federal agencies propose to improve them by building a scenic skyway that will cut across the ridge of the Shawangunks or somewhere else through an unusual region of cliffs, woods and lakes. Whatever route is finally decided on, the highway will invade and bisect a charming wilderness that has been administered many years by responsible private owners.

Daniel Smiley, one of the brothers who own the Lake Mohonk House and Park, has reason to believe that most of the private citizens of the New Paltz area do not want the quiet and privacy of the Shawangunks destroyed by a scenic highway. It will arbitrarily divide one side of the mountains from the other and introduce noise, speed, gasoline fumes and the familiar rubbish of the motor age. Since the New York State Thruway passes through New Paltz, and several other motor roads cross over the mountains or run on either side, they believe that they are well supplied with roads. Some of the roads already provide access to the woods.

Public and Private Interests

This presents a classic example of a major national dilemma. Where is the dividing line between the public and the private interest? For the public obviously has a right to the use of wild areas, and a scenic highway can be defended on that principle. If private owners are destroying a valuable wild area, the Government certainly has a right, if not an obligation, to take it before it is gone. That is the situation in Northern California, where giant redwoods that can never be replaced are being cut for lumber.

But the Shawangunk Mountains (pronounced Shongum) have been preserved for nearly a century by private owners who regard their property not only as a source of income, but as a public trust as well. The best known are the Smiley Brothers, who are the fourth generation of a family that operates a large, old-fashioned hotel on Lake Mohonk. Mohonk is a jewel-like lake that somehow manages to accumulate a deep reservoir of water, although it is 1,000 feet above sea level. There is still an element of mystery about the source of the water.

Since the Smiley Brothers own 7,500 acres of woodlands, fields, dramatic rock formations and a lake, to say nothing of many buildings, their opposition to the proposed skyway can be regarded as self-interest. But Daniel Smiley has been a naturalist ever since he lived at Lake Mohonk as a boy. Because of his wide knowledge of wildlife, he became a crusading conservationist long before the skyway was proposed.

A Model Program

Like most of the Smiley family, he is a Quaker, scrupulous in all his business and personal affairs; and he and his brothers have tried to preserve at Lake Mohonk an atmosphere of quiet and modesty that has a spiritual value. Apart

ACROSS the United States, many private owners of undeveloped land are taking steps to preserve it in a wild state, so people of the future, as well as of today, may gain inspiration and enjoyment from the undisturbed landscape. Yet there are constant threats to these wild areas, chiefly from highway encroachment and housing projects. Any highway cut through an area where wild creatures live, where native trees grow tall and wild flowers bloom in abundance, damages wild land irreparably. Homes and feeding routes of wildlife are destroyed; drainage patterns are altered, light and other factors which affect plant life are also changed. (See Conservation Handbook published by the Brooklyn Botanic Garden.)

The story told here by Mr. Atkinson is but one example of the tragic lack of understanding of nature on the part of many public works administrators. It gives evidence of the compelling need for education which will highlight the role of nature in man's world.

Daniel Smiley, one of the owners of the land in quetion here, was the recipient in May 1964 of an American Motors Corporation Conservation Award.

from administering a venerable hotel that has a strong Quaker character, they have found room in their enormous tract of land for public hunting, picnicking, hiking, rock climbing, skiing, camping and nature study. Access to the land is controlled by payment of fees. The controls are designed to preserve the woodlands in their natural state.

Skyway or Unchanged Wilderness?

Can the Federal Government do as well? It would be foolish to argue that it can. By its physical presence, the highway will destroy forever the secluded character of a mountain enclave where trees, plants, birds and animals carry on a natural "civilization" that is millions of years old and gives depth to the civilization of human beings. The civilization around motor highways is superficial and trivial.

An amendment to the Senate bill authorizing the skyway specifies that the planning must "avoid the altering or changing of the wildernesslike character" of the Shawangunk Mountains. That will be impossible. Once the skyway crosses the mountains, the wildernesslike character will be annihilated.

* * *

POTSMANSHIP

(*Continued from page 41*)

on the sand frame, perhaps with a soil warming cable for bottom heat. I use a 6 ft. × 3 ft. frame in this way, with mist propagation in summer, and bottom heat without the mist in winter. This system works wonderfully well in large institutions where cuttings are inspected almost daily. With the amateur's lack of time and more haphazard methods, cuttings are less seldom inspected and often root deeply into the sand, making extraction difficult and disturbance of neighboring cuttings unavoidable.

To avoid this situation, I now cover the whole area of the sand frame with the smallest thimble pots [2 inches in diameter] I can obtain, embedded up to their rims and filled with a mixture of four parts sand and one part loam. The thimbles "contain" the roots, and need little attention; subsequent potting-on is less hazardous, and plants are more readily available for giving away. ◆

NEW FIRE-FIGHTING CHEMICAL

Gelgard, halting combustion by sealing off oxygen supply, has saved a giant forest tree and a tiny bird

Adapted from *Dow Diamond*, No. 3 of Vol. 27, 1964

A GELATINOUS substance which, by "thickening" water rapidly, enables it to adhere to any surface, has been used during the past year with dramatic results in fire fighting and control. The new product, called *Gelgard* (manufactured by the Dow Chemical Company, Midland, Michigan), extinguishes fire by sealing off its oxygen supply.

This was what ended the eight-day fire started by lightning in the giant sequoia tree known as "Moses" in Sequoia National Park, California, last August. On the eighth day, after the fire had appeared subdued, a new blaze broke out 50 feet from the top of this towering tree. A helicopter loaded with Gelgard and water was sent up. By precision flying, it was possible to drop the mixture on the side of the tree from which the fire was emerging. Within a few hours the flames were gone and did not reappear. The giant was saved.

Later in the year, Gelgard was used to create a favorable habitat for a diminutive songbird, Kirtland's warbler, which nests only in a limited area of Michigan. As told in *Dow Diamond:*

A controlled fire released the seeds from this pine cone so that new growth could start.

Gelgard sprayed from a helicopter saved the life of a giant in Sequoia National Park.

> It builds nests of pine needles and fine grasses on the ground in thickets of young jack pine trees. When the pine gets too large, the warbler looks for a new habitat.
>
> Historically, wild fires in Michigan's jack pine country provided an abundance of natural nesting areas. But, over the years, forest fire protection practices have become so effective that there have been few new jack pines.
>
> The jack pine is peculiar in that its cones will stay closed for years without opening unless enough heat—like that of a forest fire—is generated to pop them open. Millions of seeds then drop to the ground to produce young trees.

The U.S. Forest Service cooperated with the Michigan Conservation Department in burning a selected site (a former logging area) in order that this tiny lemon-breasted bird might be perpetuated. While the place was burning, Gelgard was dropped from the air over the flaming slashings. Combustion was halted and the fire was kept within prescribed bounds. Meanwhile the jack pine cones popped open and released their seeds. Kirtland's warbler will soon have a new nesting area.

BEFORE THE BULLDOZER COMES

What citizens, community planners and trained designers can do to keep its work from being destructive

Grady Clay

Condensed from *Landscape Architecture*, October 1964

EVERY day a few more thousand Americans wake up to find a bulldozer in the back yard. Yesterday, this was "their" back yard. Today it is the bulldozer's.

It may be a sleepy householder waked up by the grunting and snorting. Or a motorist choking on new dust. The discovery is the same: that vacant lot out back which everybody thought "belonged to the neighborhood" does, in fact, belong to a developer. That swampy back acre which "we all thought was a public sort of place" has been sold, in fact, to the man now filling it up for apartments. The same in dry country, only dustier. That distantly beautiful blue-green hillside which signaled "mountain country" to the tired city-dweller is now a dreary pile of rubble and rock because its mineral rights belonged to a mining company, even though the surface rights belonged to the local park commission.

In response to all this, there is a growing anti-development feeling abroad in the land. Some of it is near-psychotic. Some of it merely attacks symptoms: bulldozers, erosion or pollution. But the bulldozer, we must remember, is merely an efficient instrument of a vigorous, production-minded society which, up till now, cared little for the quality of its visible environment.

Why not admit that the bulldozer is inevitable, that cities must grow, population expand? Once this is granted, we can concentrate on the important job of *administering* such growth and expansion —for beauty as well as for workability, for amenity as well as economy.

Nobody likes to be "administered." Yet if we are to have more than "slurbs," we must first set about administering our total environment, and do it carefully and continuously.

Secondly, if we are going to keep ahead of the bulldozer, we must put more faith and investment in plans and planners. These fellows are no more immune to error than you or I, but they wrestle with an important device: the formal, comprehensive plan for neighborhoods, cities, watersheds, or regions. They need surveillance and review—but also more support, as well as teamwork assistance from professional designers.

Thirdly, the trained designer must be given (or should fight to get) a responsible place in environmental administration. You cannot separate "design" from "plan," nor apply "good design" like lipstick. The aesthetic approach is a way of arriving at decisions, and it can best be done by those who are formally trained for the job.

Thus the central task is to train sufficient designers to work with the landscape, with buildings, with regional resources, with whole cities—so that the thousands of local development plans will benefit from their skill. This is the task for the next decade. It requires subsidy on a scale never yet attempted: a much higher percentage of our gross national product spent on this particular kind of education and administration.

The role of schools of architecture—both landscape and building—should be expanded, for example, by offering seminars in aesthetics for public officials who must assume such responsibilities. Trained task forces in outdoor recreation could be made available to local communities. Design competitions for new regional and national parks could be promoted.

All this should become a part of administering our new environment. Then, when the bulldozers arrive, we will have plans and designs ready for them to follow. ◆

A new collection of

RHODODENDRONS AT BROOKLYN BOTANIC GARDEN

Robert S. Tomson

TO DISPLAY the finest rhododendrons available and suitable for culture in the Metropolitan New York area and in regions of similar climate, the Brooklyn Botanic Garden has greatly enlarged its rhododendron planting. The beds, covering some 5,000 square feet of ground, now accommodate more than 400 specimens of nearly 300 species and hybrids.

The new planting site, established in 1961 under the guidance of Edmund Amateis,* is on essentially level ground, sheltered on the north by a hill and bounded by a downward slope to the south. With such a terrain, adequate air drainage is assured.

Several large oaks in the vicinity provide mottled patches of shade. This protection from full sunlight is particularly desirable for the larger-leaved rhododendrons if leaf burn is to be avoided.

As the area was initially well drained and the soil was found to be a clay loam, the only addition to the beds as a whole was well-rotted horse manure. This was plowed in to a depth of one foot. To further augment the organic content of the beds, peatmoss was incorporated with the soil mixture as each rhododendron was planted.

Soil acidity has remained near the optimum point for rhododendrons since the garden was constructed. Although no subsequent attempt has been made to adjust the pH, a soil sample taken within the last year gave a reading of 4.9.

The New York metropolitan area has an average January temperature of 35°F. and an average minimum of 5°F. Actual conditions are more favorable than these figures would indicate. The proximity of large bodies of water and sheltering buildings, coupled with the effect of thousands of chimneys blanketing the city with their heat, tends to ameliorate the extremes of winter weather.

With these factors in view, there was reason to believe that some of the less hardy rhododendrons might thrive in this area. This proved to be the case. The initial selection of rhododendrons included the larger-leaved types (the "iron-clad" Catawba hybrids), some of the new and somewhat tenderer Dexter hybrids, and most of the other desirable English and German hybrids.

The first and largest planting was completed in the fall of 1961. This was supplemented by smaller plantings in the fall of 1962 and spring of 1963.

As the plantings were completed, a 2-inch layer of wood chips was applied as a mulch. For additional protection during the cold months, each winter a snow fence is erected along the north side of the beds.

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*Mr. Amateis served as Botanic Garden Rhododendron Consultant for the years 1961 and 1962. Sculptor by profession, he is widely respected as an amateur rhododendron grower and breeder. Among his introductions are 'Dora Amateis', 'Mildred Amateis' and 'Louis Amateis'. The beautiful white-flowered 'Dora Amateis', named in honor of Mr. Amateis' mother, won top honors when it first appeared at the 1958 New York Flower Show. More of his splendid hybrids, some already named, will be available from commercial nurseries in the future.

Meanwhile, some of the above-named varieties are presently obtainable from the nursery of Warren Baldsiefen, Paramus, New Jersey. Mr. Amateis sold his Connecticut home and nursery and retired to Florida in 1960.

The winter of 1961-62 was about average in temperature, the low point being 4°F. on February 11. As there was very little snowfall, the newly established plants were denied the benefit of this insulating medium. During the following winters (1962-63) snow covered the ground a larger portion of the time but high winds (over 60 miles per hour on December 31, for instance) combined with lower-than-average temperatures (2°F. on February 8) made this a severe test for some of the more tender specimens.

By contrast, the winter of 1963-64 was comparatively mild, the recorded low being 9°F. on January 14. There was little snow, but the lack of its protection was not serious in the absence of high winds.

The amount of precipitation since the new Rhododendron Garden was planted is not considered a decisive factor in the survival of the plants, as the soil moisture has been adequately maintained by occasional soaker-hose watering, aided greatly by the wood-chip mulch.

Some losses from various causes occurred among the newly established plants, especially the more tender varieties. Most rhododendrons with a hardiness rating of H-3, supposedly "fairly hardy in southern Long Island and around Philadelphia," * would be expected to live through the winters previously described, and plants with this rating or higher made up the majority of those placed in the collection. The remaining specimens had a rating of H-4 (hardy to + 5°F.) and were placed in the beds for test purposes, as chances for their survival in this area were doubtful.

At the end of the first three winters, fewer than 14 per cent of the plants with an H-3 hardiness rating or above were lost from all natural causes, while 50 per cent of those with a rating of H-4 had succumbed. Among the latter were *Rhododendron arboreum* and its variety 'Blood Red,' also 'Azor,' 'Dido,' 'Earl of Athlone,' 'F.C. Puddle,' 'Thomwilliams,' and the species *fulvum, mallotum, meddianum, scyphocalyx, tephropeplum,* and *zaleucum.*

Presently promising tender (H-4) kinds are the varieties 'Azma,' 'Blue Tit,' 'Elizabeth,' 'Hugh Koster,' 'Humming Bird,' 'Van Nes Sensation'; also the species *concatenans, davidsonianum, dichroanthum, leucaspis, megeratum, moupinense, neriiflorum, trichostomum* and *wardi.*

This list serves to emphasize the variability of plants and the difficulty horticulturists have in assigning hardiness classifications. ✦

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*David G. Leach: *Rhododendrons of the World.*

WASHING HANDS AND CLOTHING AIDS IN VIRUS CONTROL

AT THE Glasshouse Crops Research Institute in Littlehampton, England, investigators have found that the virus "TMV," which causes a serious disease of tomato and tobacco, persists in leaf debris and on workers' clothing. Surprising as it may seem, dry cleaning is less effective than washing with detergents in removing the virus from the clothing. With the major source of the virus being the seeds (the virus particles are inside the seed coats), it is important to wash the hands frequently when handling transplants. This reduces the chance of mechanical transmission.

Man doubtless plays an unsuspecting role in the transmission of many kinds of viruses—J.T.W. ✦

STARLINGS—
A HUNDRED MILLION OF THEM

While they consume insects and larvae, to most growers they are pests; trapping offers partial solution

G. Ronald Austing from National Audubon Society

Benjamin P. Burtt

Condensed from *The Conservationist*, October-November 1964, published by the State of New York Conservation Department, Albany, New York.

THEY started in Central Park, New York City, in 1890. In that and the following year, one Eugene Scheifflin—with good intentions but little foresight—loosed 100 European starlings in the Park. They were the first in the United States. Two years ago the Audubon Society's Christmas bird count reported 10,000,000 starlings at scattered locations throughout the Nation. Starlings now make up the largest population of any single bird species in the United States; certainly there are at least 100 million altogether.

Their number might not be objectionable if they did not possess a quality prized among humans—sociability. For in the fall they gather in flocks of thousands and descend upon orchards and crops. And in winter they jam together in small areas of cities and towns where people jam together. In Syracuse last winter, some 150,000 roosted on buildings in a downtown section.

Starling Migrations

For the first six years they were in this country, they were confined to New York City. In the next 25 years they spread through the East from Virginia to Nova Scotia and westward to Ohio. In the following 25 years they covered the United States westward to Kansas and Texas. Now they have reached the West Coast and they have been reported in 616 of the 672 places in the United States counted by the Audubon Society.

A cynic could say that the bird is almost human: It is gregarious, reproduces rapidly, and has little regard for what it does to its surroundings. Flocks have stripped orchards of fruit in a few days. The loss of apples, grapes, dates, berries and grain crops from the European starling comes to $28,000,000 annually in the United States.

Birds in Human Communities

When the starling descends on a human community, the damage is of a different nature. In the fall, at sunset, flocks often literally cover the trees in residential areas. During the winter, swirling clouds of these birds descend to concentrate on a few city blocks in downtown sections. Droppings cover the neighborhood, dry up and blow around as dust. Few birds carry diseases transferable to humans and there is no proof that the starling is guilty on this count. Yet their wide distribution, their habit of crowded living, and their concentration in human communities during winter would appear to make them a potentially dangerous transmitter of bacterial diseases and viruses.

It is unlikely that the starling can be eliminated from this country. And they do consume numbers of insects and larvae. Thus there will always be a considerable number to help native bird species control insect pests. But if the number of starlings were cut to one per cent of the present total, there would be no great loss—and the gain in lessened damage to communities would be tremendous.

Causes of the Problem

How came the population burst of the starling? The first boost came, and still comes, from man's own wastefulness and untidiness in the United States—shown in his garbage dumps. At dawn the birds take off from their roosting places and spread out for miles looking for food. In the northern half of the United States, very clearly there is insufficient natural, growing food in winter. But outside of all too many communities, large and small, there are open garbage dumps and they provide ample food for the starling. Otherwise, it would be forced to move southward in winter.

Shelter is provided by abandoned buildings, structures in disrepair, and older buildings with many nooks and crannies. These places in cities are also warmer than the open countryside.

The tremendous populations of the starling at the beginning of winter are one present guarantee of their continuance. This is true from the fact that such large populations can sustain inevitable winter losses, and yet come into the spring with sufficient numbers to provide a large base of breeders for the new season. Thus, if the number surviving until spring could be decreased, the problem of the downtown roosts and fall flocking in residential areas would be decreased. This is the main principle upon which the City of Syracuse has rested its starling control program: Reduce the number of breeders.

Methods of Control

Suggested methods of control may be evaluated as follows:

1. Poisoning of birds is contrary to the State Conservation Laws. It is generally difficult to poison a particular species of bird or animal without killing pets and wildlife.

2. The use of noises or sounds as a scare device merely moves the birds to some other area, where they can again become a nuisance. Distress calls of the starling have been used in some residential areas in the fall where the birds roost until the leaves fall. The technique is complicated and one must use the sound for short periods and in different ways. The sound must carry throughout the roost. These factors make the use of distress calls in downtown areas quite ineffective.

3. Other methods include attempts to make the buildings less comfortable for birds. Sloping boards or cement can be placed on sills and ledges so that perching is difficult, but this can be expensive. These areas can be greased or coated with irritants to the birds' feet.

4. Removing their food. Syracuse has improved its situation by making certain that garbage at dumps is compacted and covered by about six inches of dirt each day. Areas in which landfill is complete, must, of course, be covered with earth to a greater depth. These steps not only cut down on

the food supply for the starling, but they decrease rat problems as well.

5. Trapping.

The best way to control starlings at the present time in addition to cutting down on their food supply is to carry out an extensive trapping program. These birds are not protected by either Federal or State law and hence the procedure is quite legal. Relatively inexpensive traps can be constructed of chicken wire. These are large box-like affairs and the birds go in to get food or to be with other starlings which are unable to escape. Such large traps can take up to 2,000 birds in a 24-hour period on a good trapping day. An experimental trapping program was started in Syracuse in the late winter of 1963-64. Two traps on different dumps where the birds fed were operated for about 10 weeks. Another was put into operation on the roof of a ten-story downtown building in the center of the roosting area. The downtown trap proved to be the most efficient.

Some 55,000 starlings were captured and disposed of before the flocks broke up and dispersed for the breeding season. Such a program to be effective undoubtedly must be continued, for the starlings drift about the country from year to year and they multiply rapidly during the spring and summer.

The Syracuse program is scheduled for continuance from early in the fall of 1964, through the winter until dispersal takes place in early April. It is expected that the reduction in numbers during the first half of the winter will decrease the population below the nuisance level for the rest of the season. Probably a continuous program each winter will be required.

For details on trap construction, write the author at Syracuse University, Syracuse 10, New York. ✦

FARM CROPS WITHOUT SOIL

Drought-ridden island raises food economically in demineralized sea water fortified with nutrients

ON the Island of Aruba off the coast of Venezuela, where poor farm land and frequent droughts have made agriculture impractical, a "nutriculture" farm has been set up. Preliminary experiments had shown that crops of superior quality could be raised on a commercially sound basis without using soil.

The food plants are being grown in gravel-filled tanks 100 feet long, 3 feet wide and 1 foot deep. The nutrients supplied in the water with which they are flooded are adjusted to the needs of each different kind at each period of its development. Because the plants can be set closer together here than in a field, and because there can be several crops a year (no wait other than time to clean the tanks between harvesting and planting), they produce 15 to 20 times as much as on the same area of soil.

There is no danger of drought or of erosion of land: soil diseases are absent and other diseases and pests are easily controlled; there is no need for crop rotation or cover crops to be plowed under. Attention to nutrients means that the produce can be made to contain high amounts of minerals and vitamins. And the cost is such that fruits and vegetables can be purchased at a lower price than previously on the island.

While the system installed on Aruba is based mainly on the work of W. F. Gericke at the University of California a quarter-century ago, it involves some new engineering techniques being put into practical use for the first time. Among other things, demineralized sea water is being largely used for irrigating the plants.

Aruba's nutriculture farm is under the Island's Department of Economic Affairs. The manager is S. R. Robins, a graduate of Johns Hopkins University. ✦

GARDENER'S MISCELLANY

Brief notes from 1964 publications

Wasps for Japanese Beetle Control. Tiphia wasps from Japan have been released in Illinois and Indiana in the hope that they will help keep Japanese beetles under control. Female wasps seek out Japanese beetle grubs in the soil, sting them, then lay eggs in their paralyzed bodies. On hatching, the wasp grubs feed on the beetle grub, spin cocoons, and emerge to continue the cycle. If successful, this means of biological control could reduce the use of poisonous sprays.—Wildlife Management Institute, Washington, D. C.

Plastic Spray for Trees. To reduce transpiration and thus save trees during droughts, thin plastic sprays are being tested at the University of California at Davis and at the Weizman Institute in Israel. Under usual conditions, it is said that 99 per cent of the water absorbed by the roots is lost by transpiration through the leaves, doing little good along the way. Reduction of this loss would result in less water being drawn from the soil and would also relieve internal water stress that occurs on hot days.—*The Journal of Commerce*, November 13.

Rhododendrons from Seed. Rather than risk the loss of native rhododendrons by trying to transplant them, it is recommended that they be grown from seed, which is best collected in the autumn and started indoors in flats of peat or sphagnum moss in February or March. The third year the seedlings can be set in nursery rows or in a secluded part of the garden to grow to landscape size. All the steps are described in one of the correspondence courses offered by The Pennsylvania State University, University Park, Pa. The course is available for one dollar, addressed to 201 Agricultural Education Building.

Apple Grading. A machine that beams light through apples detects and automatically rejects those with hidden defects. Developed by the Marketing Service of the U. S. Department of Agriculture.

Dwarfed Poinsettias. Extending the work of the U. S. Department of Agriculture at Beltsville, Md., experiments at the University of Missouri show that Cycocel is effective in reducing the height of poinsettias. Its use also results in producing darker green leaves, sturdier stems and more compact bracts. Plants propagated in August gave the best response, but different varieties behaved differently, the white and pink poinsettias proving more difficult to dwarf. —Bulletin 806, Agricultural Experiment Station, Columbia, Missouri.

Demonstration Garden. The Neighborhood Garden Association of Philadelphia, in cooperation with the Agricultural Extension Service, has opened a demonstration garden in West Philadelphia to stimulate neighborhood improvement. Half of the area contains a series of small gardens: front and back yard gardens, shrub, perennial, rose and herb gardens, vacant lot, patio, shade and paved city lot gardens, and window-box plantings. The remainder is devoted to 4-H Club demonstration projects.—*The Pennsylvania Horticultural Society News*, August.

Spring in Winter. Hardy irises can be made to bloom indoors several months before they would flower outside. Plants potted up in late fall and left in the cold for at least five weeks, then fertilized, and placed in good light, indoors, will flower eight weeks later. Plants dug during a January thaw can be forced indoors immediately.—*Better Homes and Gardens*, January.

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GRAVEL PITS

(*Continued from page* 36)

leveling is carried out during the summer months, followed by grass sowing in the early autumn and finally tree planting.

A Continuous Process

The work of landscaping should be a continuous process carried out at frequent intervals throughout the life of a gravel pit. Treated in this way, gravel workings can be made to look attractive in a short time. Furthermore, the cost can be spread over a number of years, and earth-moving equipment can be put to work at times when it might otherwise be standing idle. ✦

WORTH READING

A Supplementary List of Significant Articles, Bulletins and Books Published During 1964

ARTICLES AND BULLETINS

Pesticides

Pesticides—in Our Ecosystem. Frank E. Egler. *American Scientist,* March, pages 110-136. A discussion of the effects that pesticides have on all elements of the areas they reach, coupled with a remonstrance against the lack of accurate information about pesticides for the users. With the human environment being rapidly and dangerously altered, the author maintains, insufficient research is being undertaken to enable man to cope sensibly with the situation; and when information does filter down to the public, it is often one-sided aud erroneous.

Interagency Coordination in Environmental Hazards (Pesticides). Hearings before the United States Senate Committee on Government Operations. Parts 1, 2, 3 and 4, pages 1-389, 391-595, 597-833, 835-1044; 75, 60, 65 and 60 cents a copy, respectively. Available from the Superintendent of Documents, U. S. Government Printiug Office, Washington, D. C., 20402. A significant contribution to information on pesticides and their effect on wildlife, farm stock and human beings, as well as on the crops they are intended to protect. There are repeated statements as to the need for greatly expanded research on the part of industry and government and for broader education concerning pesticides.

Farmers' Checklist for Pesticide Safety. Tells how to avoid damage by proper selection and handling of pesticides. Six pages. Catalog No. A 1. 68:622. Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. 5 cents.

Water

A Primer on Ground Water. Helene L. Baldwin and C. L. McGuinness. Geological Survey, U. S. Department of the Interior. 26 pages, illustrated. Available from Superintendent of Documents, U. S. Goverumeut Printing Office, Washintgon, D. C. 20402. 25 cents.

Water in Plant Life. T. W. Sudia. *Minnesota Farm and Home Science,* Spring. Institute of Agriculture, St. Paul, Minn. The role of water within a plant and in the surrounding soil and atmosphere is explained. (A corn plant may use over 400 pounds of water in transpiration during its growing season.) Entire issue devoted to water.

Garden Practices

Twigs to Trees. Olive S. Bowes. *News of the Federated Garden Clubs of New York State,* Fall. Author tells how she has raised 350 kinds of woody plants from seeds and cuttings.

Plastic Mulch. Donald Wyman. *Arnoldia,* April 17. Placing a layer of black polyethylene film on the soil as a mulch around a tree or shrub at planting time is shown to be the surest and most inexpensive way of obtaining good growth during the first five critical years. Arnold Arboretum, Jamaica Plain, Massachusetts.

Avoid Damping-Off Easily. Gordon Morrison. *American Nurseryman,* January 15. Watering seedlings only when the sun is shining and preferably at midday is a good preventive for post-emergence damping off. Adequate warmth and ventilation for the seedlings are essential after watering.

Community Compost Pile. Charles Allonby. *Flower and Garden,* November. How householders of Neosho, Missouri, cooperate with the city's department of public works and with the local garden club to create a compost pile that provides humus for flower boxes and gardens throughout the city. Formula and schedule are given.

Outdoor Housekeeping with Sprayers and Dusters. 29 pages, illustrated. A manual on equipment and its proper use, with safety tips by Cynthia Wescott. National Sprayer & Duster Association, 410 North Michigan Avenue, Chicago. Illinois 60611.

Special Plants

Succulents for Use. Emily Brown. *Notes from Strybing Arboretum*, April, pages 13-18. Decorative ways of using succulent plants indoors and outdoors are described and illustrated with photographs. Strybing Arboretum Society, Hall of Flowers, Golden Gate Park, San Francisco 18, California.

Ground Covers for Today's Landscapes. Charles H. Potter. *American Nurseryman*, September 1. About 50 species listed with botanical and common names, growth habit, rate, height, site preferred, characteristics, flower color and period of bloom.

Accent on Annuals. F. F. Rockwell. George J. Ball Company, West Chicago, Illinois. Lavish color illustrates this 25-page guide, which tells how to select and plant annuals, also how to fit them into the general garden plan. 25 cents.

Chrysanthemums for the Home Garden. John R. Culbert and James A. Fizzell. Circular 883, University of Illinois Cooperative Extension Service, Urbana, Illinois. 16 pages.

Let's Grow Lilies, written and illustrated by Virginia Howie for the North American Lily Society. 50 pages. Line drawings illustrate all aspects of lily culture and the glossary of terms as well. Available from Ernest F. Stokes, Treasurer, 21 Oakland Street, Lexington 73, Massachusetts. $1.00.

Greenhouse Equipment

A System for Winter or Cool-Weather Ventilation. Rebecca T. Northen. *Under Glass*, November-December. Lord & Burnham, Irvington, New York. A perforated polyethylene tube, 18 inches in diameter, draws in outside air just below roof level and lets it mix with the warm air of the greenhouse before it reaches the plants. The setup is at Colorado State University, Fort Collins, Colorado.

New Ideas for Plastic Greenhouses. *Farm Journal*, November. Among the up-to-date products and practices described are long-lasting vinyl plastics, ultra-violet light absorbers, double plastic walls, ventilation tubes, and aluminum-treated plastic that lets in light but not too much sun in summer; also an irrigation system that is turned on automatically when solar energy is built up to a certain point.

Botanic Gardens

Second Decade Program. A 16-page illustrated booklet relating the history and future plans of the Saratoga Horticultural Foundation, P. O. Box 308, Saratoga, California. Evaluation of shade trees for western gardens and production of improved varieties have been among the foundation's accomplishments which are to be continued.

The U. S. National Tropical Botanical Garden. Subtitled "A proposal based on an urgent need," this 24-page illustrated booklet points to the need for a tropical botanical garden in Hawaii. Published by the Hawaiian Botanical Gardens Foundation, Inc., in care of the Experiment Station, 1527 Keeaumoku Street, Honolulu 14, Hawaii.

How to Plan an Arboretum. *Quarterly Newsletter*, No. 61, American Association of Botanical Gardens and Arboretums. G. William Longenecker, Editor, University of Wisconsin Arboretum, Madison, Wisconsin. Articles include: Design in Arboretums and Botanical Gardens, John C. Wister; Planning an Arboretum, Clarence E. Godshalk; Landscape Design Emphasis in the Morton Arboretum Housing Development, Anthony Tyznik; Arboretum Master Plan, George W. Longenecker; Landscaping an Arboretum, John M. Fogg; An Arboretum in a Landscape Setting, Carl F. Wedell.

Conservation and Land Use

Rural Land Use Planning. An appeal to communities to reserve and plan now in the interest of future wildlife resources and recreation. Forestry and Wildlife Extension Service, 111 Forestry Building, Pennsylvania State University, University Park, Pa.

The Preservation of Deserts. Edmund C. Jaeger. *The Nature Conservancy News*, Fall. 2039 K Street, N.W., Washington, D. C. 20006. A warning from past experience and a guide to those who wish to preserve typical areas in American deserts in their natural condition.

A Nature Center for Your Community. Joseph J. Shomon, 40 pages. $1.00. ***Planning a Nature Center,*** Byron L. Ashbaugh. 88 pages. $2.00. ***Manual of Outdoor Conservation Education.*** Joseph J. Shomon. 96 pages. $2.00. All 8½ x 11 inches, paper bound, illustrated. The set, $4.50. Reduced prices for 10 or more. National Audubon Society, Nature Centers Division. 1130 Fifth Avenue, New York, N. Y. 10028.

BOOKS

Special Garden Plants

The Chrysanthemum Book. Roderick W. Cumming. 301 pages, 23 drawings by Allianora Rosse, 24 black-and-white photographs, plus 15 in color. D. Van Nostrand Company, Princeton, New Jersey. $7.95.

A comprehensive book covering every aspect of chrysanthemum culture and propagation, training and exhibiting, besides the detailed techniques of breeding and the growing of hybrid seedlings to maturity. Control of pests and diseases is made clear through tables that follow the explanatory text.

Hardy Garden Bulbs. Gertrude S. Wister. 176 pages, 11 drawings by Eleanor A. Medford, 23 photographs by J. P. Roche. E. P. Dutton and Company, New York, $4.50.

Basic information on bulbs and their culture is followed by chapters on the important kinds, miscellaneous bulbs for every season, and hardy bulbs to force for indoor bloom. Descriptive lists single out those that are easiest to grow.

The Miniature Rose Book. Margaret E. Pinney. 149 pages, 139 line drawings, color illustrations by the author showing 22 varieties, color photographs by Gottscho-Schleisner of four arrangements by Edna Whitsitt. D. Van Nostrand Company, Princeton, New Jersey. $5.95.

Detailed records kept by the author over 18 years of growing every available kind of "baby" rose, indoors and out.

Introduction to the World of Orchids. G. C. K. Dunsterville. 103 pages (8½ x 11), illustrated by the author with 40 full-color plates of Venezuelan orchids and with numerous drawings. Doubleday & Company, Garden City, New York. $11.75.

A book designed and written for the layman. Cultural notes are given with the descriptions for some of the orchids illustrated.

You Can Grow Orchids. Mary Noble. 152 pages, drawings, many photographs, 24 in color. Revised third edition, paper bound. Published by the author, 3003 Riverside Avenue, Jacksonville, Florida. $2.50.

Once their requirements are carefully provided, the author shows how orchids can be as easily grown as any other indoor plant.

Cacti and Other Succulents. R. Ginns. 191 pages, 125 photographs, 8 drawings, mostly of individual plants. A Penguin Handbook prepared in conjunction with the Royal Horticultural Society. Penguin Books, Baltimore, Maryland. Paper bound, $2.45.

Gentians for Your Garden. Doretta Klaber. 141 pages, 5 color plates, 40 line drawings of species, 1 of seedlings and 4 illustrating methods of culture, all by the author. M. Barrows and Company, New York. $4.50.

The Camellia Treasury. *For Gardeners, Flower Arrangers and Exhibitors.* Mrs. Paul Kincaid. 224 pages, 88 photographs (mostly by author), 16 color plates. Hearthside Press, New York, $9.95.

All About Geraniums. Peggie Schulz. 175 pages, 116 black-and-white photographs, 9 photographs in color, line drawings by Isabel Jones. Doubleday & Company, Garden City, New York, $4.95.

Geraniums and Pelargoniums. H. G. Witham Fogg. 156 pages, 37 photographs (2 in color), 8 drawings. John Gifford, Limited, London; Charles T. Branford Company, Newton Center, Massachusetts. $4.50.

The Polyanthus [primrose], its History and Culture. Roy Genders. 231 pages, colored frontispiece and 45 photographs showing methods of culture, types of flowers, floral structure, pollination, propagation, and polyanthus primroses in gardens. Charles T. Branford Company, Newton Center, Massachusetts. $3.95.

Flowering Trees for Year-Round Color in Southern California. Philip Edward Chandler. 36 pages, 35 color plates by Ralph D. Cornell. California Arboretum Foundation, Inc., 301 North Baldwin Avenue, Arcadia, California. Paper bound. $1.50; 20% discount on orders of 100 or more.

Special Types of Gardens

Seaside Plants of the World. *A Guide to Planning, Planting and Maintaining Salt-Resistant Gardens.* Edwin A. Menninger. 303 pages (6½ x 9¼), 408 photographs. Hearthside Press, New York, $9.95.

Sand and wind, salt spray and occasional flooding are enemies of plants grown at the ocean's edge. To add to his own experience, the author has collected facts and photographs from seaside gardeners of every climate the world around. Each of some 1,500 species treated is keyed to its place of origin, availability in the trade, degree of hardiness and relative toughness.

Espaliers and Vines for the Home Gardener. Harold O. Perkins. 206 pages, 24 photographs, 10 drawings, endpaper hardiness maps. D. Van Nostrand Company, Princeton, New Jersey. $6.50.

How to plant, support and train an espalier, with 50 ornamental plants suggested for espaliering. How to select, grow and use vines, with 70 kinds described.

The Gardener's Fern Book. F. Gordon Foster. 226 pages, 71 pages of line drawings and 16 full-color photographs by the author, besides many black-and-white photographs. D. Van Nostrand Company, Princeton, New Jersey. $7.95.

The first comprehensive book on gardening with ferns outdoors and in the house.

The Picture Book of Perennials. Arno and Irene Nehrling. 286 pages, more than 250 drawings and photographs (8 pages in color). Hearthside Press, New York. $5.45.

Illustrations and descriptions of perennials, with cultural needs, in alphabetical order, represent the choices gleaned from 300 questionnaires sent to professionals and to highly experienced amateurs.

Herb Gardening in Five Seasons. Adelma Grenier Simmons. 353 pages, 13 photographs, many line drawings by Kathleen Bourke. D. Van Nostrand Company, Princeton, New Jersey. $6.95.

The fifth season is Christmas, when fragrant herbs are used in decorations, foods and gifts.

Wild Flowers to Know and Grow. Jean Hersey. 235 pages, paintings of 200 species in full color by Allianora Rosse. D. Van Nostrand Company, Princeton, New Jersey. $6.95.

Brief descriptions of wild flowers arranged by color, followed by suggestions for establishing different kinds in varied locations. An extensive section on protecting wild flowers gives credit to Alice Harvey Hubbard, author of "This Land of Ours."

Create New Flowers . . . *Indoors and Out.* John James. 211 pages, 29 photographs (4 pages in color). Doubleday & Company, Garden City, New York, $4.95.

A how-to-do-it book, with suggestions for a plant hybridization program for the home gardener.

Rock Gardens, How to Plant, Establish and Maintain. George Schenk. 112 pages, 8½ by 11, illustrated with photographs by Don Normark and with drawings. Lane Book Company, Menlo Park, California. $1.95, paper bound.

House Plants for City Dwellers. Alys Sutcliffe. 159 pages, drawings by Eva Melady, photographs by Jeannette Renshaw. E. P. Dutton & Company, New York. $3.95.

The essence of years of teaching at the Brooklyn Botanic Garden on how to grow plants in city houses and apartments.

Book of Lawn Care, 85 pages, illustrated.
Book of Trees and Shrubs, 118 pages, illustrated.
Book of Home Landscaping, 118 pages, illustrated.

Three new books edited by Joan Lee Faust, Garden Editor of *The New York Times.* Alfred A. Knopf, New York. $2.45 each.

An Easy Guide to Artificial Light Gardening for Pleasure and Profit. Vernon Johnston and Winifred Carrière. 192 pages, 13 photographs, 31 drawings. Hearthside Press, New York. $4.50.

Gardening and Cooking on Terrace and Patio. Dorothy Childs Hogner. 179 pages, illustrated with drawings by Nils Hogner. Doubleday & Company, Garden City, New York. $3.95.

Trees and Shrubs for the Southeast. Brooks E. Wigginton. 279 pages, plus 23 photographs showing landscape uses. University of Georgia Press, Athens. $7.50.

Herb Gardening. Claire Loewenfeld. 256 pages, 8 photographs by John Gay. Charts for growing and using herbs. Charles T. Branford Co., Newton, Mass. $5.95.

Japanese Gardens

Landscape Gardening in Japan. Josiah Conder. Supplement of 40 plates and new preface by Clay Lancaster. 251 pages (8½ x 11), profusely illustrated. Dover Publications, Inc., New York. $2.75.

An unabridged and corrected republication of the second (revised) edition of 1912 of Conder's classic of 1893, beautifully produced. The publisher has done a great service in making this long out-of-print book again available. This basic work on Japanese gardens has not yet been surpassed.

Designing Japanese Gardens. Katsno Saito. 229 pages (8 x 11½), many drawings and photographs, some in color. Text in Japanese. In English: section headings, plant names and decriptions of most illustrations. Gihodo Company, Limited, 5 Tameike, Akasaka, Minatokn, Tokyo, Japan (Japan Publications Bureau, Tokyo). $14.75.

Garden Plants in Japan. Fumio Kitamura and Yurio Ishizn. 266 pages, 270 illustrations, 23 in color. Kokusai Bunka Shinkokai (The Society for International Cultural Relations), Tokyo.

From the book: "Published in the hope that it will fill the need for a guide to the plant material found in the gardens of Japan. It has been made possible through contributions from members of the Garden Club of America as an expression of their appreciation for the generous hospitality shown them on their visit to Japan in May 1961. It is intended for complimentary distribution to assist visitors to Japan in the identification of garden plants."

General Gardening

The Complete Book for Gardeners. Rachel Snyder, Editor. 508 pages (7½ x 10 inches), 17 full-color photographs, 215 black-and-white photographs, 84 line drawings. D. Van Nostrand Company, Princeton, New Jersey. $9.95.

For Better Gardens. *A Down-to-Earth Garden Manual.* Roland A. Browne. 278 pages. Doubleday & Company, Garden City, New York. $4.95.

Pest Control

The Gardener's Bug Book. Cynthia Westcott. 625 pages, 36 plates of full-color illustrations of 102 pests, by Eva Melady; 95 line drawings, mostly of other pests. Third edition, completely rewritten and reset. Doubleday & Company, Garden City, New York. $9.95.

A welcome new edition of a basic reference work, well organized and clearly enough written to be of help to any gardener, yet technical enough to meet the needs of the professional.

Keep Your Garden Healthy. Louis Pyenson. 256 pages, about 100 illustrations of garden pests and their effects on plants. E. P. Dutton and Company, New York. $4.95.

Practical directions for home gardeners, clearly presented in tabular form at the ends of chapters. The first book for the amateur to state the toxicity of every chemical compound mentioned and to weigh this danger against the importance of the product in keeping plants free from pests.

Peacock Manure and Marigolds. *A "No-Poison" Guide to a Beautiful Garden.* Janet Gillespie. 184 pages, The Viking Press, New York, $3.95.

An entertaining personal-experience account of gardening successfully without the use of chemicals that are poisonous to human beings.

Gardening without Poisons. Beatrice Trum Hunter. 314 pages, chapter headings drawn by Bob Hines. Houghton, Mifflin Company, Boston. $5.00.

Methods of biological control of plant pests occupy the major portion of this book.

All About Bonsai

Bonsai. Chuzo Onuki. 67 pages, 108 photographs in color. Jitsugyo No Nihou Sha Company, Limited, Tokyo, Japan. $75.00.

Nearly half a century of bonsai experience, during which the author developed his own methods of cultivation, are the background for this book. His techniques and the many fine illustrations in full color, give this book a distinctive touch.

Bonsai—Miniature Potted Trees. Kyuzo Murata. 114 pages, 96 photographs (6 in color), 77 drawings. (No. 1 of a "How to" series.) Shufunotomo Company Limited, Tokyo. $5.50. Available from the Brooklyn Botanic Garden.

Mr. Murata, owner of the Kyukaen Bonsai Garden in Omiya, Saitama Prefecture, is probably the best known bonsai grower and artist in Japan. This book answers all questions on bonsai, guides the beginner in his selection of trees, containers and soil, discusses watering, pruning, winter care and control of pests and diseases, as well as showing in photographs how branches should be arranged and wired. A very comprehensive study.

Bonsai: Trees and Shrubs. *A Guide to the Methods of Kyuzo Murata.* Lynn R. Perry. 234 pages, 61 photographs, 1 diagram, 1 map. The Ronald Press Company, New York. $7.50.

Miss Perry lived in Japan for some years, studying gardens and serving as a member of the staff of the Agricultural Attaché at the American Embassy in Tokyo. While there she studied bonsai with Kyuzo Murata, the prime bonsai grower in Japan, at his Kyukaen Garden in Omiya. She has set down his techniques faithfully, and made suggestions as to how these might be applied in the United States. Full directions are included for pruning and care of 67 kinds of woody plants. There is a chapter on importation of bonsai into this country from Japan.

Bonsai for Americans. George F. Hull. 256 pages, 16 drawings. Doubleday & Company, Garden City, New York. $5.95.

Mr. Hull, skilled writer, photographer and bonsai hobbyist, has given a full and well illustrated account of bonsai in America, the materials used, techniques and care. Most of the photographs are his own, and the drawings are by his wife.

Bonsai—The Art of Dwarfing Trees. Ann Kimball Pipe. 188 pages, 65 photographs, 61 drawings. Appleton-Century, New York. $5.95.

The bonsai expert, it is said, must know how to spot "gei," an untranslatable Japanese word suggesting charm, personality and style, in any tree destined for bonsai training. Other topics in the book include potting, watering, feeding, seasonal care, pruning, shaping, and special styles.

Flower Arrangement

Modern Asbstract Flower Arrangements. Emma Hodkinson Cyphers. 128 pages, 64 photographs of compositions by different arrangers. Hearthside Press, New York. $4.95.

The eighth Hearthside book by this master arranger and teacher, whose own work is in large part based on art forms as they are expressed in nature.

Japanese Free Style Flower Arrangement. Lee Early Quinn. 116 pages, 75 illustrations (52 photographs, 1 in color; 23 diagrams). D. Van Nostrand Company, Princeton, New Jersey. $5.95.

Mrs. Quinn, who studied at the Ikenobo and Ichiyo Schools of Floral Art, aims to present the "what, why and how" of Japanese free style, the freshest and most powerful influence in contemporary flower arrangement.

A Handbook of Dried Arrangements and Decorations. Mabel Squires. 95 pages, 45 photographs by Richard B. Green. M. Barrows & Company, New York. $3.25.

Flowers and Festivals of the Jewish Year. Lillian S. Freehof and Lottie C. Bandman. 192 pages, 112 photographs and 5 color plates depicting lavish floral decorations for religious holidays and ceremonials, with 14 drawings showing how some arrangements are constructed. Hearthside Press, New York. $5.95.

Community Beautification

It's Your Community. *A Guide to Civic Development and Beautification.* Henry B. Raymore and H. Stuart Ortloff. 240 pages. M. Barrows & Company, New York. $3.95.

Tells what action to take to overcome problems of modern living and get open spaces within a community—parking places, street trees, attractive roadsides and general rehabilitation. Also considers laws and ordinances that may be encountered.

Out of the Past

Gardens and People. Fletcher Steele. 221 pages. Houghton Mifflin, Boston, Massachusetts, $4.00.

An intimate book of thoughts, reminiscences and provocative ideas by a famed New England landscape architect who enjoys people as much as plants and their garden uses.

Fifty Blooming Years—1913-1963. *The Garden Club of America.* Marjorie Gibbon Battles and Catherine Colt Dickey. 98 pages (7 x 10), 50 illustrations.

A history of the accomplishments of the Garden Club of America during its first half-century. Limited edition.

A Garden Century. *The Christchurch Botanic Gardens.* 184 pages, 14 full-page color photographs, 88 in black and white, fold-in map. City Council of Christchurch, New Zealand.

Current displays, outstanding plants, and year-round routines, as well as the history of the Garden's first hundred years.

Men with Green Pens. *Lives of the Great Writers on Plants in Early Times.* Louise Bush-Brown. 161 pages, 12 photographs of some early books, their authors, and of pertinent places. Dorrance & Company, Philadelphia, $5.00.

Translation of a portion of the Egyptian Papyrus Ebers of 1552 B.C. opens this historic work. In the rest, biographies are given of Theophrastus, Dioscorides, Albertus Magnus, Bartholomaeus Anglicus, Otto Brunfels, Leonhard Fuchs, William Turner, Nicholas Monardes, and John Gerard.

The Story of Gardening. Richardson Wright. 474 pages, illustrated. Dover Publications, New York. Paperback reprint, $2.

The Gardener's Year. Karel Čapek, illustrated with drawings by Josef Čapek. Dover Publications, New York. Paperback reprint, $1.

Botany and Nature Study

Projects: Botany. Doris M. Stone. 250 pages, 100 line drawings, paper bound. Washington Square Press, New York. 60 cents.

An approach to botany involving simple experiments that can be done in kitchen or back yard. For students and interested laymen.

The Natural Geography of Plants. Henry A. Gleason and Arthur Cronquist. 420 pages, including 230 pages of photographs and 3 pages of maps. Columbia University Press, New York. $10.00.

The 21 chapters prepared by Dr. Gleason deal with, first, a definition of plant geography, then with plant distribution, habitat, behavior, migration, range, floristic groups and provinces, the concepts of vegetation, correlation with climate, and transitions between regions. The final chapter is Dr. Cronquist's interpretation of North American vegetation north of Mexico.

The Odyssey Book of American Wild Flowers. More than 300 color photographs by Farrell Grehan, text by H. W. Rickett. 252 pages (8¼ x 11½). The Odyssey Press, New York. $12.95.

Artistic effect rather than characteristics for identification is the aim of the photographer, who has made pictures in nearly every region of the country. All are clearly identified in the descriptions. Introductory sections deal with the floristic regions of the United States and with the structure of plants and their flowers and fruits, with explanatory drawings by the author.

Wildflower Portraits. 100 full-page plates (8½ x 11) from watercolors by Eloise Reid Thompson, with explanatory text on facing page by Edna Wolf Miner. Introduction by George Miksch Sutton. University of Oklahoma Press, Norman, Oklahoma. $15.00.

All flowers shown in natural size and color and depicted with botanical accuracy. The plates were selected from Mrs. Thompson's large collection of wildflower paintings, mostly of southwestern species.

The Secret Life of the Flowers. Anne Ophelia Dowden, artist and author. 47 pages (6⅜ x 4), illustrated in full color throughout. The Odyssey Press, New York. 95 cents.

Watercolor paintings with perfection of detail serve as the basis for text, describing the various intricate mechanisms by which some flowers are pollinated.

Photographing Nature. David Linton. 262 pages, 24 line drawings, 26 photographs. American Museum Science Books, Natural History Press, Garden City, New York. Paper bound. $1.95.

Equipment, basic techniques and how to photograph landscapes, small objects and aspects of nature in the field, in winter, under water and in special situations.

Mountain Flowers of New England. Stuart K. Harris and others. 147 pages plus 32 color plates (149 color pictures by Miriam Underhill), 61 drawings. Appalachian Mountain Club, Boston, Massachusetts. $4.50.

Wild Flowers in South Carolina. Wade T. Batson. 146 pages, full-color illustrations of 202 species; keys for identification; illustrated glossary. University of South Carolina Press, Columbia, South Carolina. $5.00.

The Southern Fern Guide. Edgar T. Wherry. 349 pages, 135 line drawings by James C. W. Chen and Keith C. Y. Chen. Doubleday & Company, Garden City, New York. $4.95.

Technical Books

The Cactaceae. *Descriptions and Illustrations of Plants of the Cactus Family.* N. L. Britton and J. N. Rose. 1,054 pages (7⅞ x 10¾), in four volumes bound as two, 137 full page plates, 1,142 text figures (photographs and drawings). Dover Publications, New York. $20.00.

Reprint of the second edition (1937) of this exhaustive study of the Cactus Family, first published in 1920 by the Carnegie Institution of Washington. No other treatment of cactus remotely approaches this in comprehensiveness.

Generic Names of Orchids, *Their Origin and Meaning.* Richard Evans Schultes and Arthur Stanley Pease. 331 pages, extensively illustrated with drawings. Academic Press, New York, $12.00.

Water Metabolism in Plants. Theodore T. Koslowski. 227 pages, illustrated. Harper & Row, New York. Paper bound, $3.95.

The Mosses of Michigan. Henry T. Darlington. 212 pages, 147 detail drawings. Bulletin No. 47, Cranbrook Institute of Science, Bloomfield Hills, Michigan. $12.00.

The Leguminous Plants of North Carolina. Robert L. Wilbur. 294 pages, 143 detail drawings of species, with distribution maps by Will Hon. North Carolina Agricultural Station, Raleigh, North Carolina. Technical Bulletin No. 151, paper bound, no charge.

Common Trees of Puerto Rico and the Virgin Islands. Elbert L. Little, Jr., and Frank H. Wadsworth. 548 pages (8 x 10½), 250 full-page drawings with text for each on facing page. Common names in English and Spanish. Agriculture Handbook No. 249. U.S.D.A. Forest Service, Washington, D. C. $4.25.

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